MARCH 1954—SIXTIETH YEAR

MACHINERY

NORMA-HOFFMANN

Efficient Seal Design
Plus Norma "Stability-Tested" Grease
Assure Maximum Trouble-Free Sealed Bearing Life

This all-important combination explains why Norma-Hoffmann sealed ball bearings perform smoothly and dependably for years.

First — the efficient seals are specially designed to seal grease in . . . keep dirt, dust and other harmful materials out.

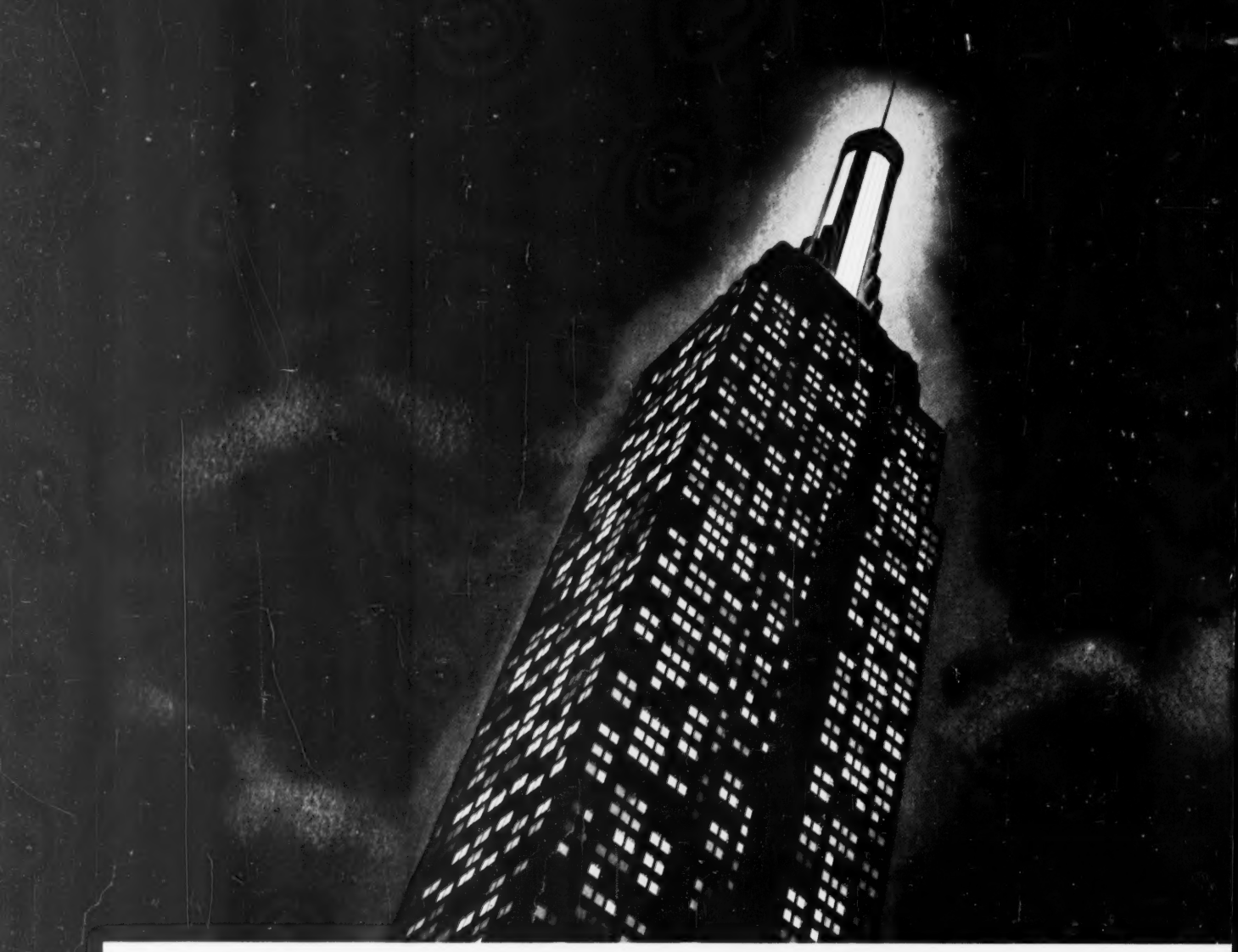
Second — the bearings are factory packed with Norma "stability-tested" grease . . . grease that is resistant to oxidation and protects against corrosion. Accurately metered grease supply provides just the right amount of lubricant for each bearing . . . assuring efficient operation for long periods without regreasing.

Norma "Stability-Tested" wide temperature range, water-resistant grease is filtered dirt-free and milled to the proper consistency. It keeps its excellent lubricating properties over many many years without drying out or hardening. Available in 8 oz. tubes, 7½ lb. cans and 100 lb. drums.

NORMA-HOFFMANN *Precision* **BEARINGS**
BALL • ROLLER • THRUST

NORMA-HOFFMANN BEARINGS CORPORATION
STAMFORD, CONNECTICUT

FIELD OFFICES: Atlanta, Birmingham, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Kansas City, Los Angeles, San Francisco, Seattle



The mooring mast that was never used!

IN MID MANHATTAN there stands a monument to a dream. A 1250-foot mooring mast that was never used!

When the Empire State Building was designed, the huge rigid-frame dirigible looked like the coming thing in air transportation. So, atop the world's tallest building, they placed a giant mooring mast. Yet before the building was finished, so was the dirigible balloon!

Why? It was knocked out of the race by the oldest law on the books. Darwin called it the survival of the fittest. We call it competition, but it means the same thing. In today's highly competitive market, it means that new ways *must be found* to produce a higher quality product, at lower cost.

That's where latest Heald equipment and a fresh Heald viewpoint can help you come out ahead in the struggle for survival. Long runs or short, single or multi-purpose setups, Heald machines provide a sure way to improve product quality, speed production and cut unit costs.

Competition is wonderful if you're *ahead* of it. Our business is to help keep you there. That's why IT PAYS TO COME TO HEALD.

HEALD

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Offices in Chicago • Cleveland • Dayton
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Internal and Rotary Surface Grinding Machines and Bore-Matics

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MACHINERY

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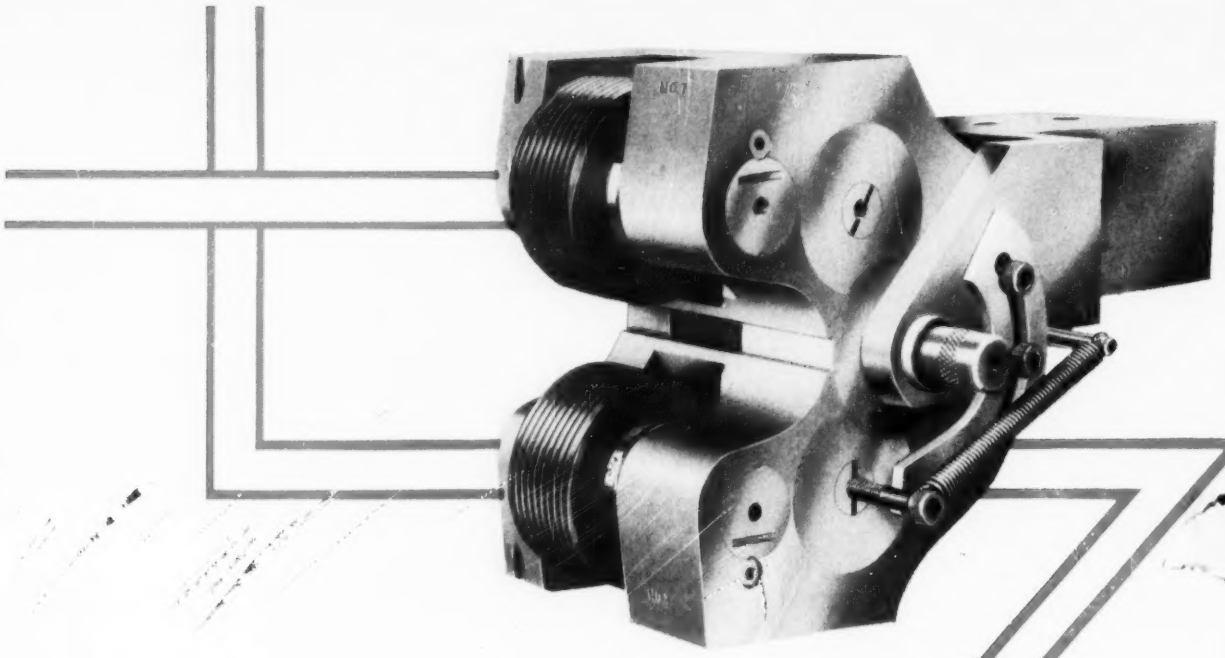
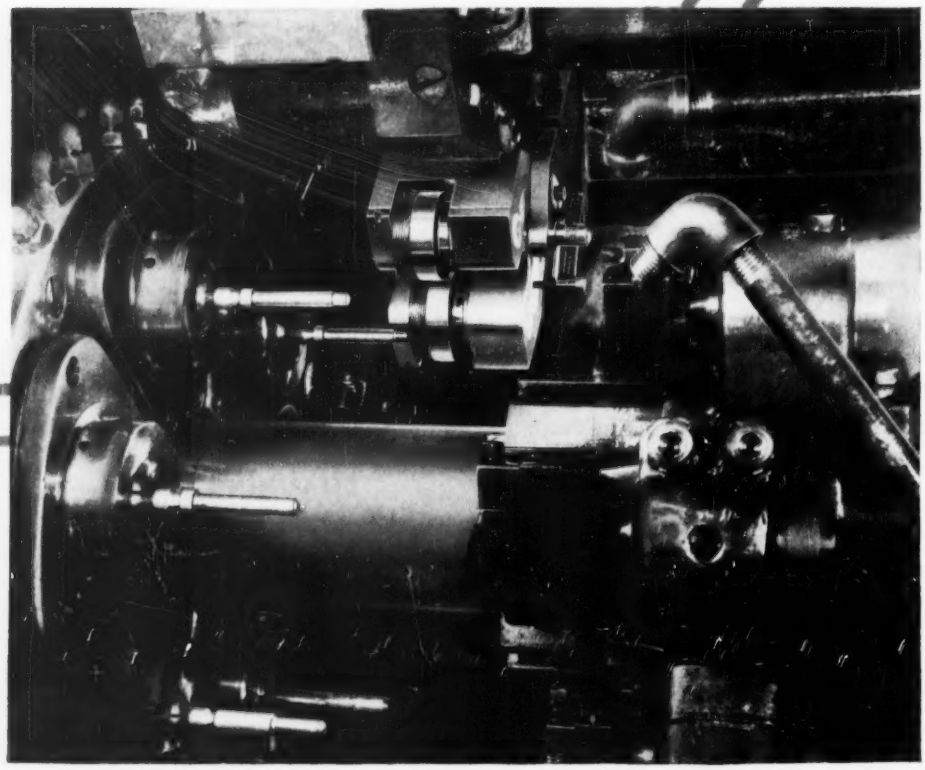


The new #18 LANROLL Attachment is shown on a $\frac{9}{16}$" RA6 Acme-Gridley Automatic at the Mac-it Parts Company in Lancaster, Pa. $\frac{1}{4}$" 20-pitch threads $\frac{9}{32}$" long are being rolled on stripper bolts of 4140 steel to a Class 4 (Class 3 required) fit within .012" of the shoulder with excellent thread finish.



Improved LANROLL Attachment for Precision Thread Rolling on Automatics

Important improvements for economical thread rolling to Class 4 limits have resulted from changes in the design and construction of the LANROLL Attachment for automatic screw machines.

These improvements, which insure a degree of stabilization between the workpiece and the attachment never previously obtained in a tool of this type, provide:

(1) A well-balanced micro structure of the workpiece through reduced sidewise pressures between the rolls and threads produced.
(2) Low gear-tooth and thrust-bearing loads.
(3) Thread rolling solid to the shoulder with no danger of roll damage.
(4) Longer roll life as rolling wear is distributed equally between the two rolls.
(5) Precision rolling of coarse pitch threads to Class 4 fit without drunkenness.

The improved LANROLL Attachment is furnished in two sizes: the #18 Attachment to permit rolling of #5-44 pitch to ½"—13 pitch threads up to $1\frac{3}{16}$" in length; and #20 Attachment for rolling ⅜" —24 pitch to 1"—8 pitch threads up to $1\frac{5}{16}$" in length. A new system of size adjustment assures operation of the Attachment for every size within its range as though it were exclusively engineered for the particular workpiece being threaded.

The improved LANROLL Attachment has other important new features: *Attachment Tipping* to avoid indexing interference, allowing a more rugged construction and the use of larger rolls, resulting in an increased number of starts and longer roll life; *Precise Timing* to avoid experimentation or near-guess timing which may result in damage to the rolls on initial rolling; *Adjustment for Taper*, to eliminate any taper which may occur, that can be made without removing the Attachment from the machine.

More complete information will be sent on request. Please send specifications when writing.

• LANDIS *Machine* CO.
WAYNESBORO PENNSYLVANIA •

see this EQUIPMENT at the ASTE Show BOOTH 1738

379-C

Here, too, GEAR
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QUALITY IS MAINTAINED

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- » *The "Red Liners"*
- » *Lead Checking Instruments*
- » *Master Gears, etc.*

The precision standards for fine-pitch instrument gears and for control system gearing in the Aviation Industry, are well served by the control of accuracy *inherent* in the Fellows generating principle.

Fellows machines and tools have demonstrated *here*, as in other industries, their ability to hold costs under control and to work within the most critical tolerances.

For advice on methods, machines, or specific production problems, call on the nearest Fellows office.

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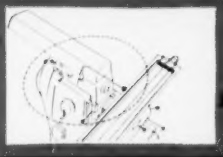
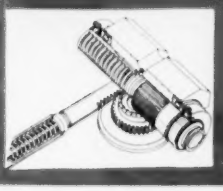
Seven Ways TO IMPROVE

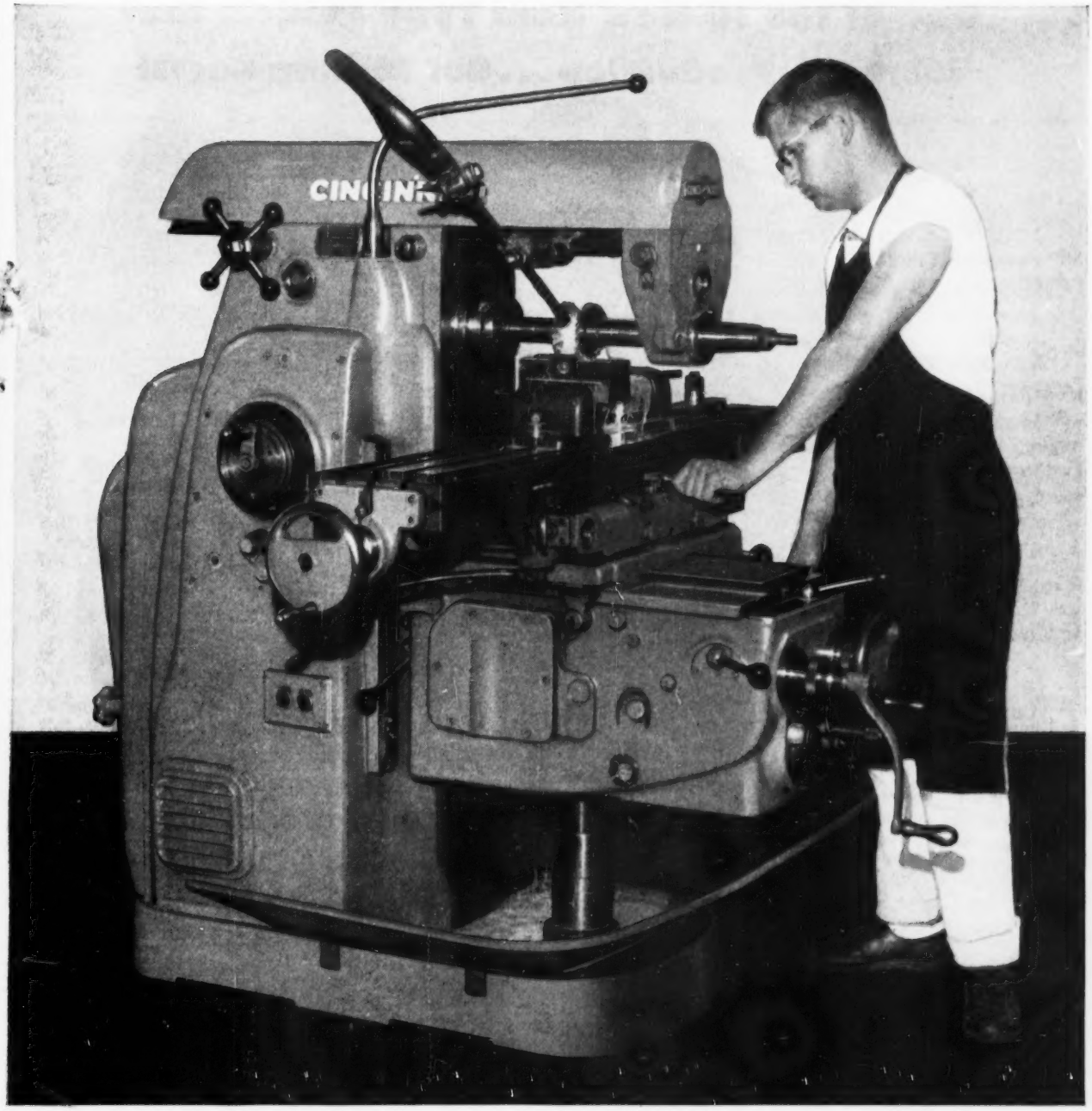
	What you should do	How CINCINNATI Nos. 2ML and 2MI Milling Machines help you do it	
1	Take heavy cuts, up to the full power of the machine when work and fixture permit.	Dynapoise overarm smooths out the cutting action.	DYNAPOISE OVERARM
2	Change speeds as often as required to maintain highest cutting efficiency and quality of finish.	Quick, easy selection of speeds, 25 to 1500 rpm, with single crank type control. One-half turn changes speeds.	CHANGING SPEEDS
3	Change feeds whenever warranted, to obtain recommended chip per tooth.	Quick, easy selection of feeds, ¼" to 30" per minute, at front of machine with single crank type control.	CHANGING FEEDS
4	Treat your milling machine with consideration: a) Do not use table as an anvil, or T-slots to tighten dog screws. b) Fill oil reservoirs as recommended.	Constructed for long life of continuous service . . . anti-friction bearings throughout . . . high-quality castings of selected grades of iron . . . automatic lubrication.	VERTICAL SCREW LUBRICATION
5	Stand close to the operating controls and levers, and be as comfortable as you can while working.	Spindle drive starting lever may be adjusted to suit working position.	 STARTING LEVER 360° PLACEMENT
6	Note the "hand" of the cutter (rh or lh) and be sure that the spindle is rotating in the correct direction.	Conveniently located spindle reverse lever, with instruction plate.	SPINDLE DIRECTION LEVER
7	Employ "climb" milling whenever it is advantageous. Especially desirable for thin parts and reciprocal milling.	Automatic backlash eliminator (extra equipment). Activated during feed stroke; free during rapid traverse.	 BACKLASH ELIMINATOR

The features and their advantages, tabulated above, give CINCINNATI Nos. 2ML and 2MI Milling Machines the highest value for toolroom and job shop equipment. The 2MLs and 2MIs offer a choice of two power ratings; 3 hp and 5 hp respectively. Brief specs. in Sweet's Machine Tool Catalog. Complete data in publication No. M-1662-2. May we send a copy to you?

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CIN

TOOLROOM MILLING EFFICIENCY



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CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

For more information on products advertised, use Inquiry Card, page 247

You Get Maximum "*Cut-Ability*" and "*Flex-Ability*" with the NEW VAN NORMAN No. 24L Miller

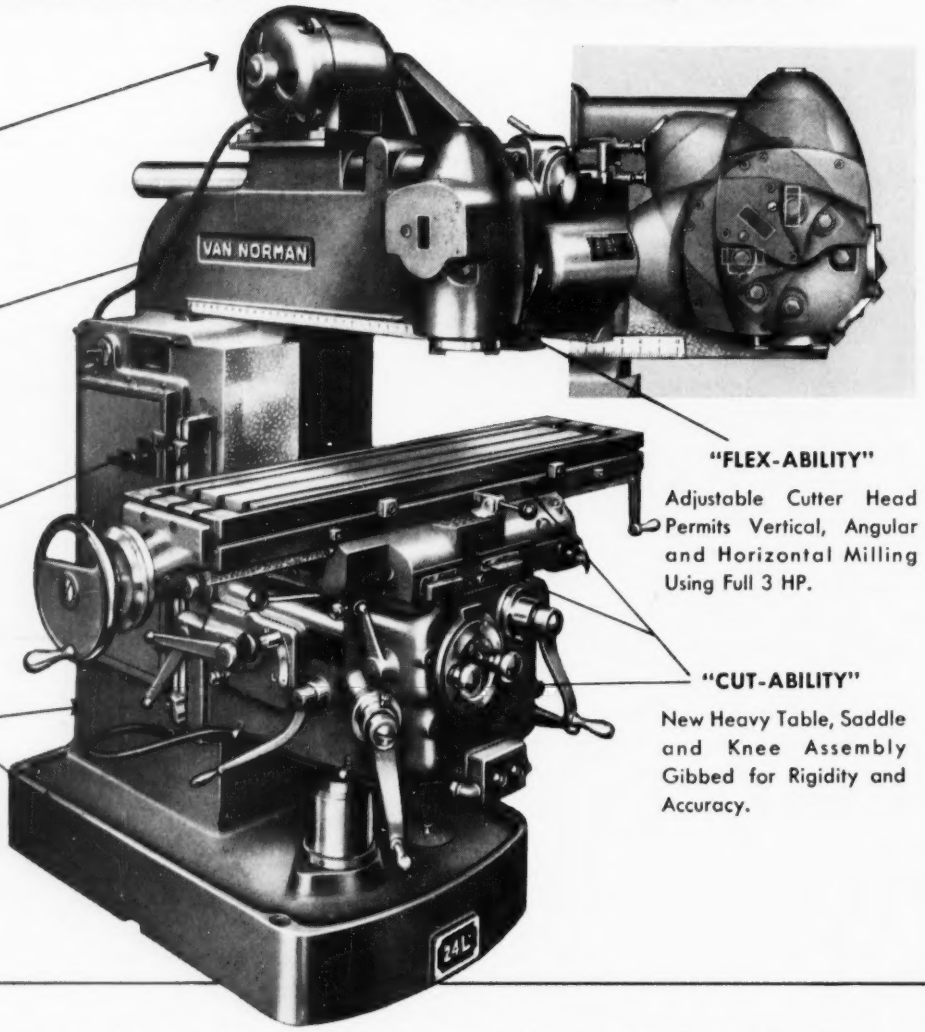
One of the 10 New Ram Type Models that Increase Production . . . Cut Milling Costs!

"CUT-ABILITY"
3HP Motor Drives Cutter Head Only.

"FLEX-ABILITY"
New Extended Ram with Large Ways, Permits Increased Range — Ram Travel 29".

"FLEX-ABILITY"
New Motor Controls with Single Lever Selector Switch.

"CUT-ABILITY"
New Larger Box Type Column Provides Maximum Rigidity. New Heavy Base Has Larger Coolant Reservoir.



"FLEX-ABILITY"
Adjustable Cutter Head Permits Vertical, Angular and Horizontal Milling Using Full 3 HP.

"CUT-ABILITY"
New Heavy Table, Saddle and Knee Assembly Gibbed for Rigidity and Accuracy.

Extra Features that Add to the "Cut-Ability" and "Flex-Ability" of the No. 24L Miller

New heavy motorized knee with direct drive feed motor mounted on knee.

"Start-Stop" buttons operate on 110 volts provided at front and rear with single lever selector switch to control use of motors.

Front and rear controls are directional . . . operate in the direction of desired table, saddle or knee movement. Exclusive Van Norman speed and feed selectors.

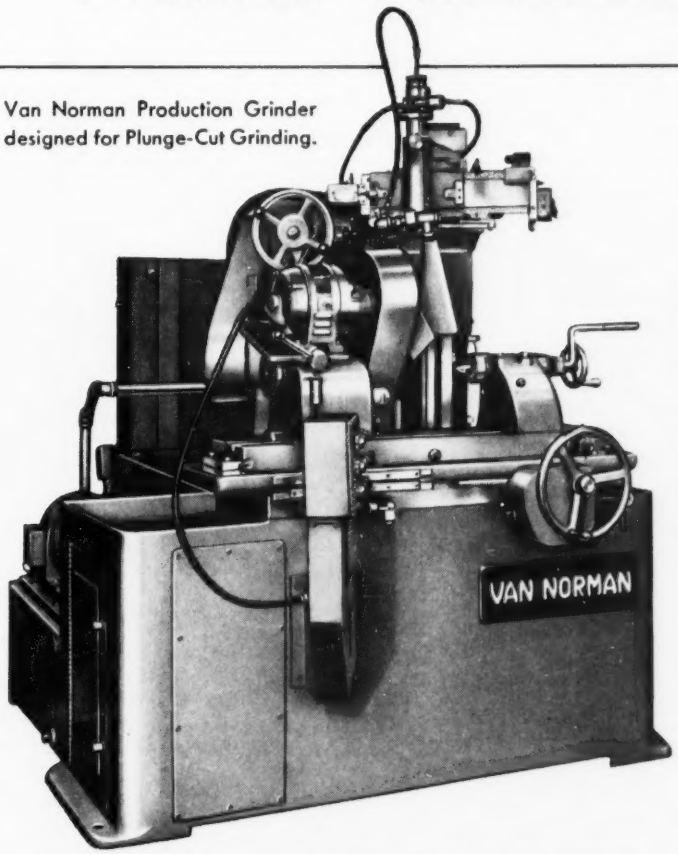
Write for more information about the new Van Norman Ram Type Millers.

VAN NORMAN Manufacturers of — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

VAN NORMAN *Special* Mass Production

Grinders Give Top Production Output

. . . Lowest "Cost-Per-Piece" Grinding



Van Norman Production Grinder designed for Plunge-Cut Grinding.

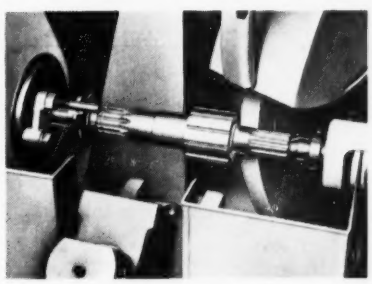
You just can't beat Van Norman Special Cylindrical Grinders for fast, economical mass production.

Van Norman designs and builds these grinders to meet your exacting requirements. Its experience in manufacturing production grinding machines since 1912 assures the utmost in performance.

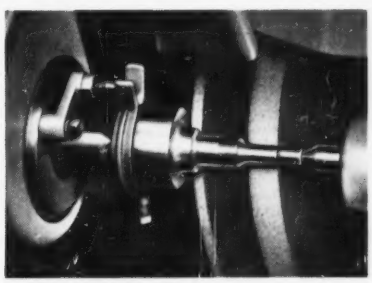
Illustrated is a typical Van Norman special production grinder designed for a major industry. Day after day this and similar production grinders are showing substantial savings by keeping production up and costs down.

If you have a mass production grinding problem, let Van Norman help you solve it. Write Van Norman Company, Springfield 7, Massachusetts.

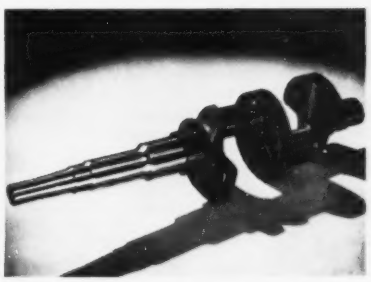
EXAMPLES OF WORK BEING MASS PRODUCED ON SPECIAL VAN NORMAN GRINDERS



Grinding a diameter and a face on a transmission shaft.



Plunge-Cut Grinding a spindle with two spaced wheels.

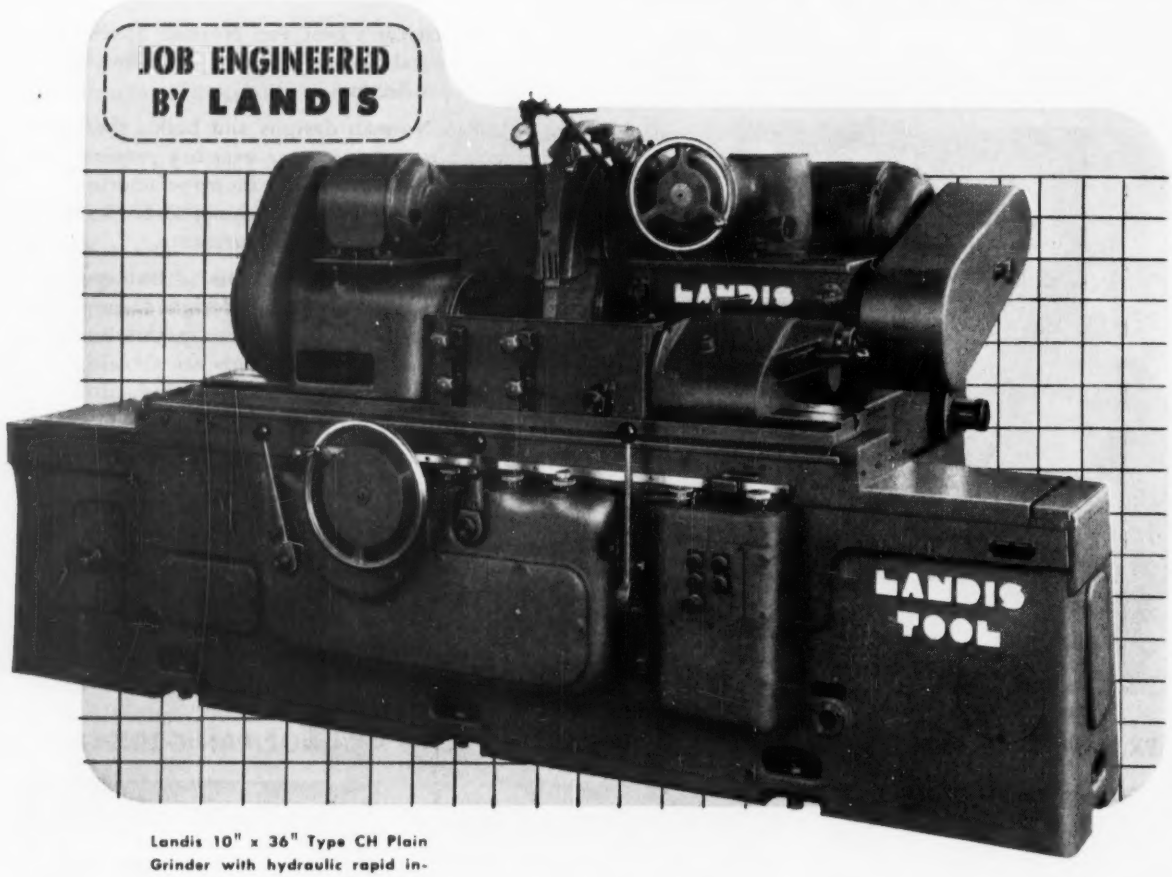


Multiple diameters, shoulders and tapers on this crankshaft are ground on double head special Van Norman Grinder.

VAN NORMAN CO., Springfield 7, Mass.

How LANDIS JOB ENGINEERING cuts grinding costs . . .

Automatic Grinding Cycles Reduce Operating Costs . . . Give Better Quality—Sustained High Production



Landis 10" x 36" Type CH Plain Grinder with hydraulic rapid infeed and sequence grinding feeds.

JOB ENGINEERED by LANDIS means grinding ideas that will make your modernization or replacement program pay off. It starts with operator convenience, hydraulic controls and simplified maintenance of a standard Landis grinder. Then, on the basis of your requirements of finish, tolerance and production, we will suggest tooling that will reduce the operating costs of your grinding department.

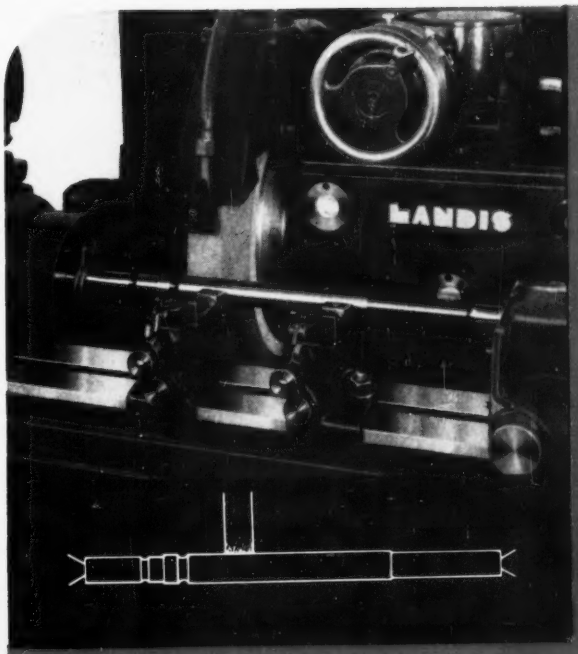
Landis Job Engineered Grinders give you a fast return on your investment because they're engineered to *your* requirements. Send us prints for tooling and production estimates. No obligation.

164

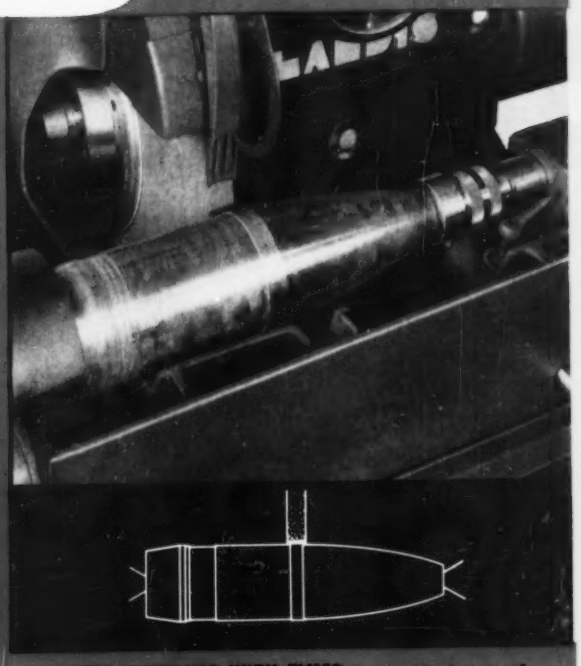
LANDIS

precision grinders

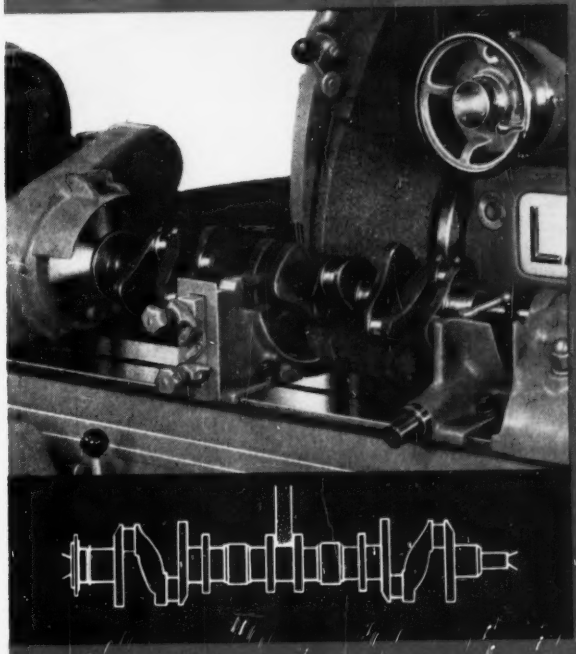
JOB ENGINEERED BY LANDIS



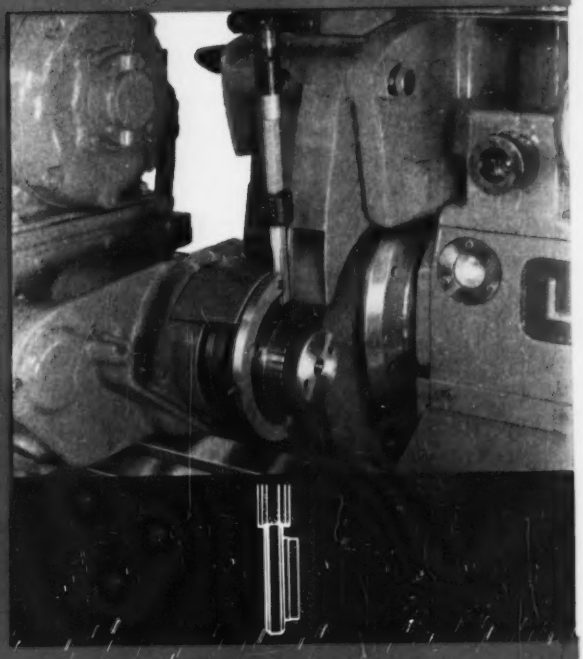
TRAVERSE GRINDING with adjustable wheel feed, at each or either reversal point, to finish size. Feed automatically re-sets.



INFEED GRINDING WITH TIMER has rapid advance of wheelhead and adjustable continuous grinding feed with timed spark-out. Automatic re-set of wheelhead and feed.



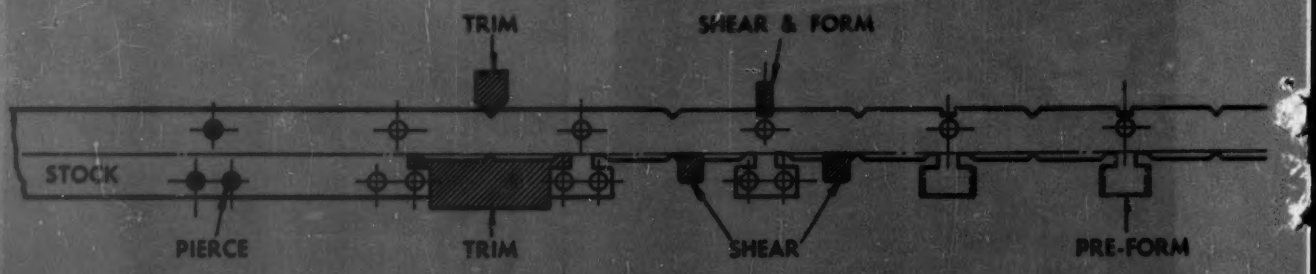
SEQUENCE GRINDING FEEDS for grinding side walls with a different feed rate than used on diameters. All feeds re-set at end of cycle.

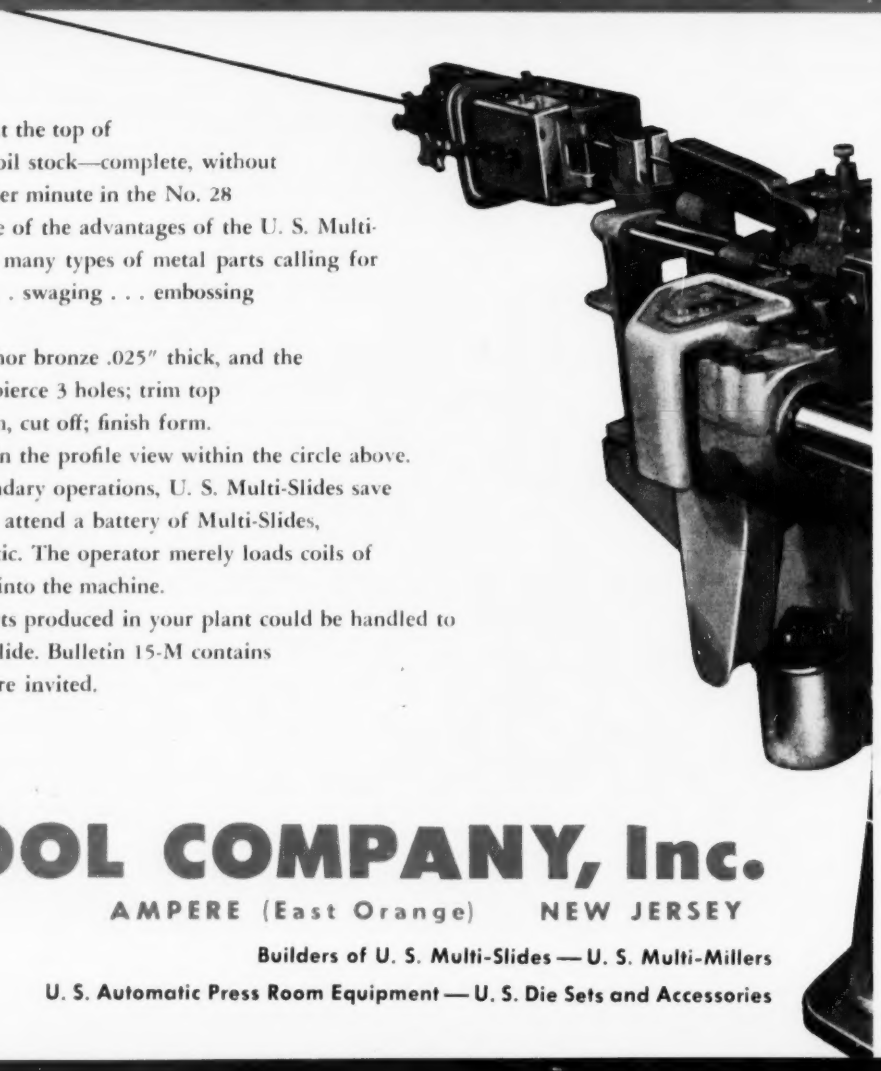


AUTOMATIC SIZING combined with straight infeed grinding. Sizing device retracts wheelhead when finished size is reached. Feeds re-set automatically.

LANDIS TOOL COMPANY • WAYNESBORO, PENNSYLVANIA, U. S. A.

Secondary Operations Eliminated! Formed Metal Stampings Produced Complete in the U. S. MULTI-SLIDE®





The electrical part shown actual size at the top of the opposite page is produced from coil stock—complete, without further handling—at a speed of 140 per minute in the No. 28 U. S. Multi-Slide ®. Another example of the advantages of the U. S. Multi-Slide for the precision fabrication of many types of metal parts calling for piercing . . . blanking . . . forming . . . swaging . . . embossing and similar operations!

The part illustrated is made of phosphor bronze .025" thick, and the sequence of operations is as follows: pierce 3 holes; trim top and bottom; shear on bottom; preform, cut off; finish form.

The last operation is shown in detail in the profile view within the circle above.

In addition to eliminating costly secondary operations, U. S. Multi-Slides save manpower, too. A single operator can attend a battery of Multi-Slides, since the operation is entirely automatic. The operator merely loads coils of material onto a stock reel for feeding into the machine.

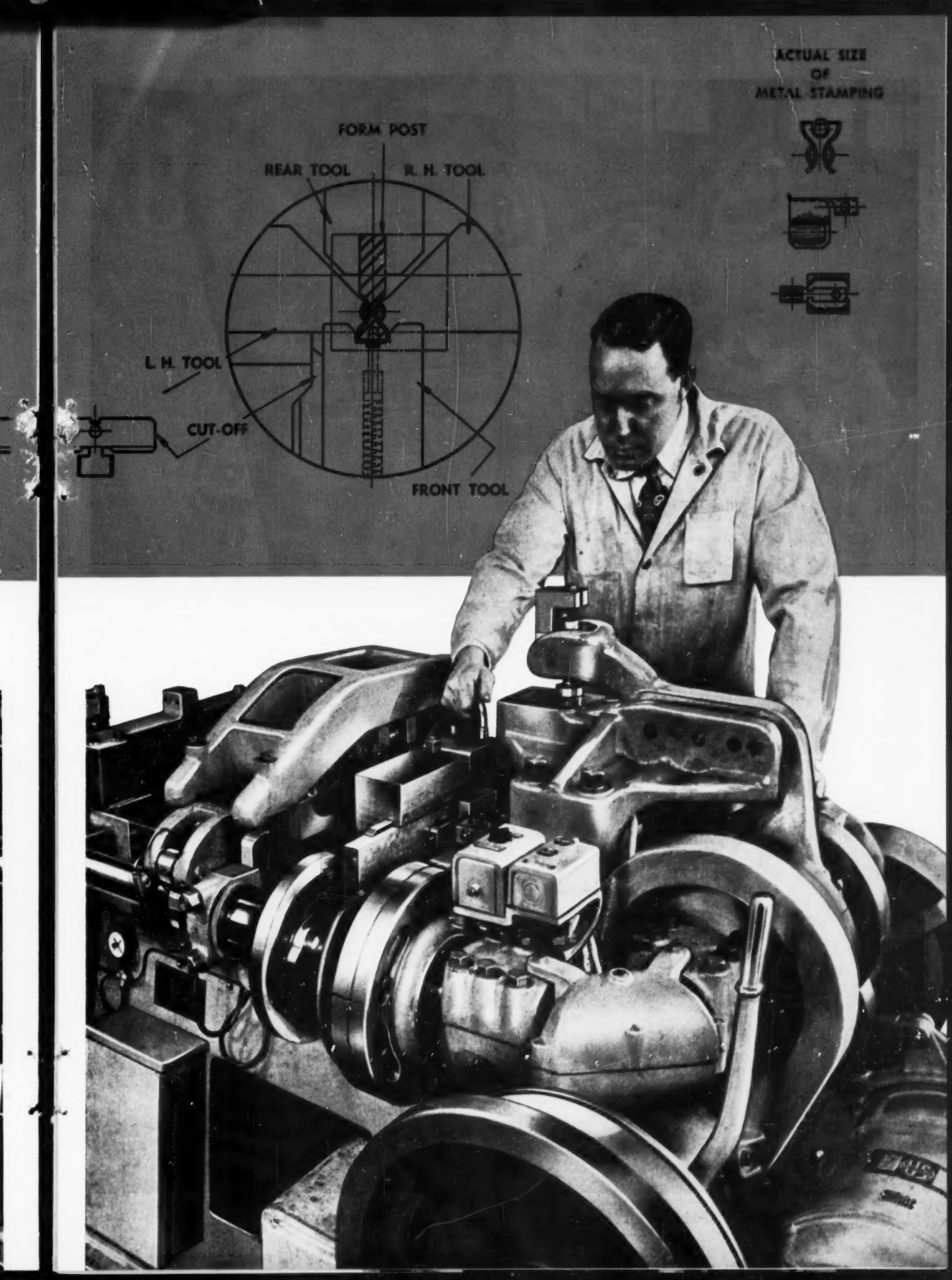
Perhaps some of the formed metal parts produced in your plant could be handled to greater advantage in the U. S. Multi-Slide. Bulletin 15-M contains complete details, and your inquiries are invited.

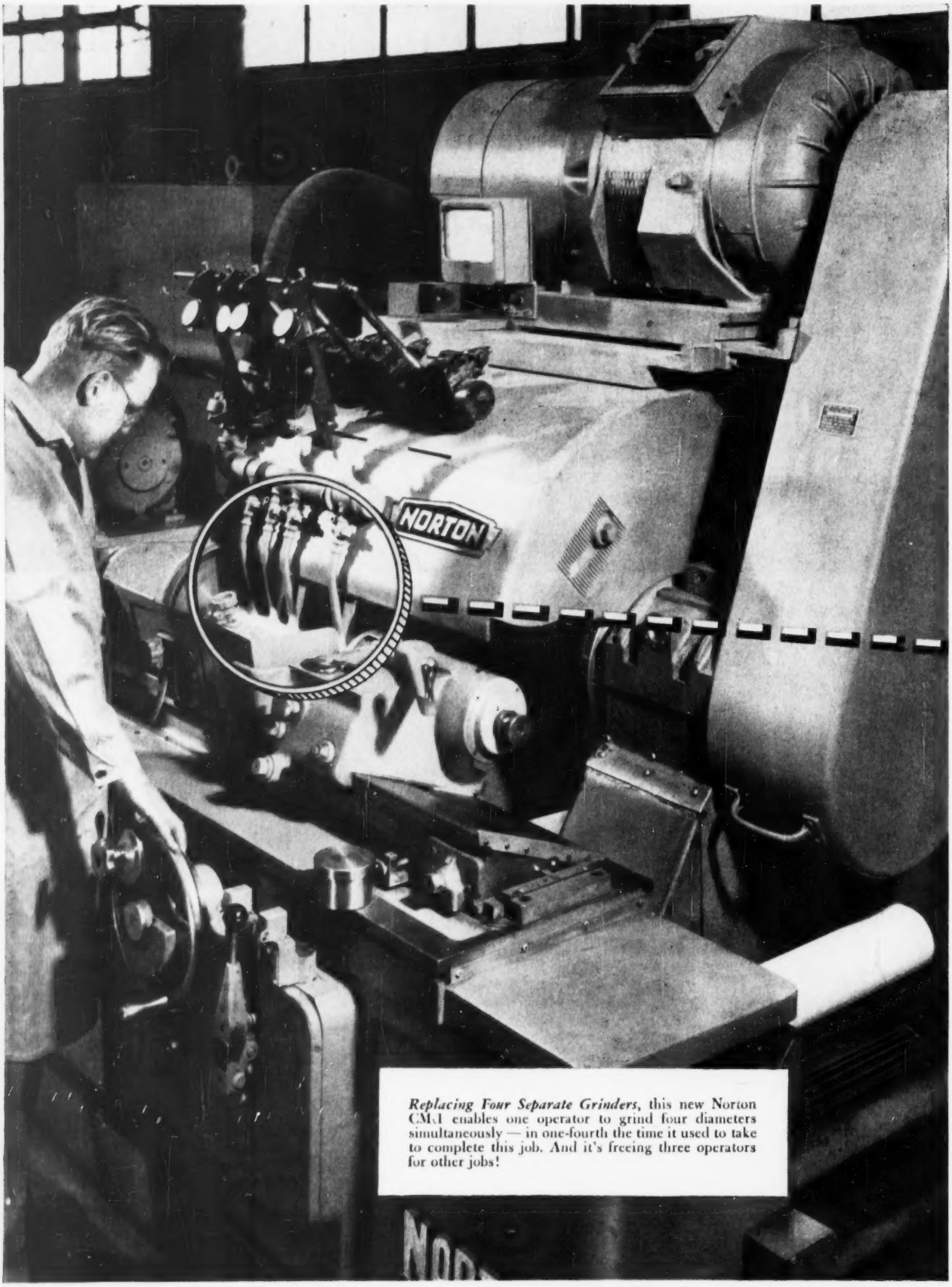
U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

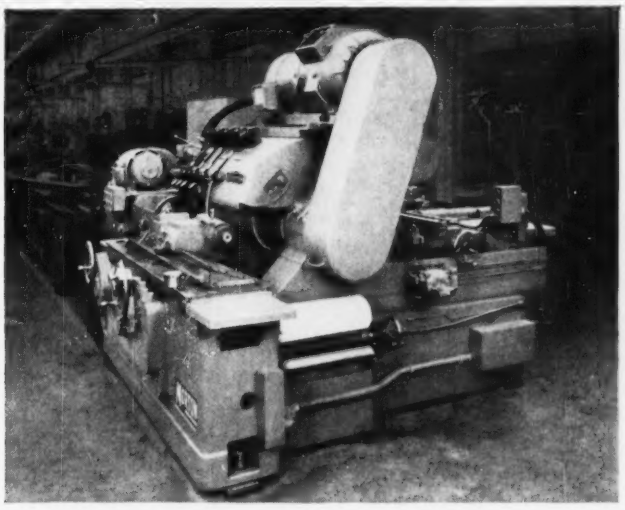
Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories


ACTUAL SIZE
OF
METAL STAMPING
FORM POST
REAR TOOL
R. H. TOOL
L. H. TOOL
CUT-OFF
FRONT TOOL



Replacing Four Separate Grinders, this new Norton CM-1 enables one operator to grind four diameters simultaneously — in one-fourth the time it used to take to complete this job. And it's freeing three operators for other jobs!



A Great New Production Tool. The Norton Type CM-1 Heavy Duty Semi-automatic Multi-Wheel Grinder brings new efficiency and economy to the grinding of parts having multi-diameters—such as crank and camshafts, transmission and motor shafts, etc.

Here's a new Norton Grinder to

boost your production rate

400% or higher

Type CM-1 Heavy Duty Multi-Wheel Grinder does four or more jobs at once, reduces capital investment, cuts operating time and costs

When you can get one machine that does the work of several, in a fraction of the working time, you save considerably on purchase costs, on operating costs, and on floor space.

That machine is now ready to go to work for you. The new Norton CM-1 makes four or more cuts in a single plunge-grind cycle, operating automatically under one-lever control. And it completes each separate grinding operation with the accurate, trouble-free performance that's built into every Norton grinding machine.

Typical Advanced Features

- Cartridge type bearings at each end of heavy, 12"-diameter wheel spindle assure extreme rigidity of spindle, longer wheel life, greater accuracy and control with minimum truing.
- **Automatic truing device — in rear, out of operator's way — trues straight or formed wheels each individually, yet all at once, thus requiring only the amount of time needed to true widest wheel.**
- Automatic compensation for collective wheel wear, including amount trued off. No adjustment or resetting of wheel needed after truing.
- **Optional equipment includes built in automatic sludge remover and coolant filter, constant peripheral wheel speed control, increased power for wheel or work drive, etc.**

Why not get the complete story of how the CM-1 can benefit your grinding operations? See your Norton Representative, or write us direct. And remember: only Norton offers you such long experience in both grinding wheels and machines to bring you the "Touch of Gold" — to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products... to make other products better

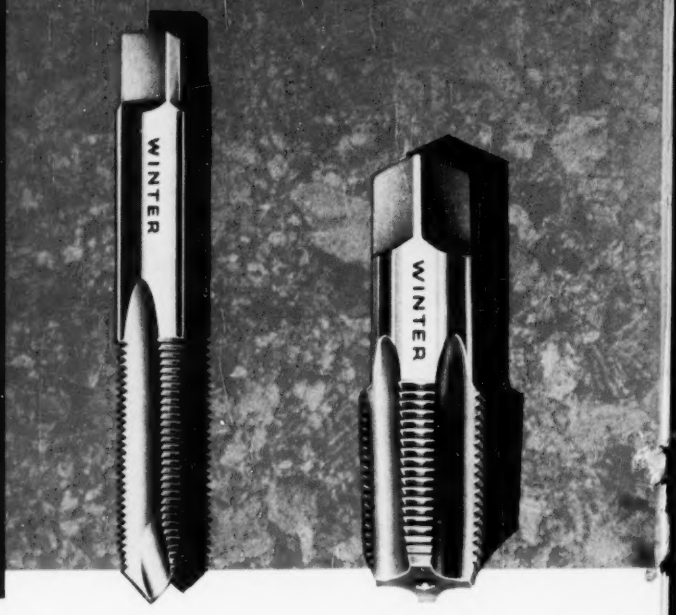
District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit

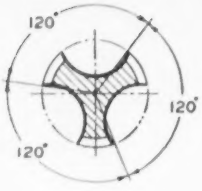
BALANCED *Action*

CAN YOU AFFORD TO USE TAPS THAT DO NOT HAVE IT?

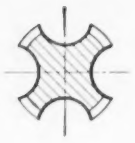
When you consider the many cost-elements that go into production, you'll agree: "It's penny-wise and pound-foolish to compromise with the *quality of the tool.*"

Specify taps with Balanced Action—an inbuilt feature of the Winter line, exclusively—for accuracy and long life.



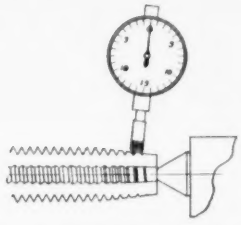


Exact Flute Spacing



Uniform Flute Contours

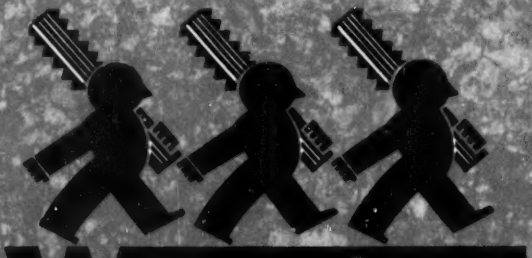
Precision Chip Driver Contours



Accurate and Concentric Chamfers

ALWAYS AT YOUR SERVICE

Your local Industrial Supply Distributer carries a complete stock of WINTER Taps



WINTER

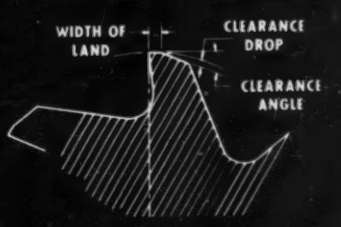
WINTER BROTHERS COMPANY

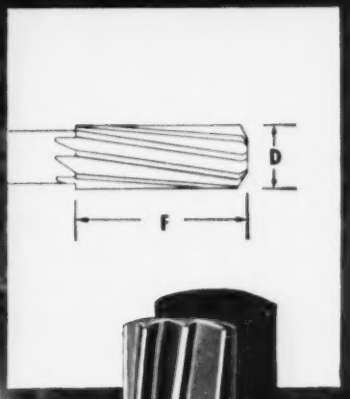
Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York, Detroit, Chicago, Dallas, San Francisco.

Division of National Twist Drill & Tool Co.

NATIONAL TWIST DRILL & TOOL
ROCHESTER, MICH., U.S.A.

National





FOR SMOOTH, ACCURATE HOLES —AND LOTS OF THEM!

National Reamers are ground to very close limits, with National's fine cutting edges. Lands and flutes are carefully proportioned. Materials and heat treatment are the finest . . . Result: *smooth, accurate holes*—and many, many of them!

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Factory Branches:
New York • Detroit • Chicago • Dallas • San Francisco

CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

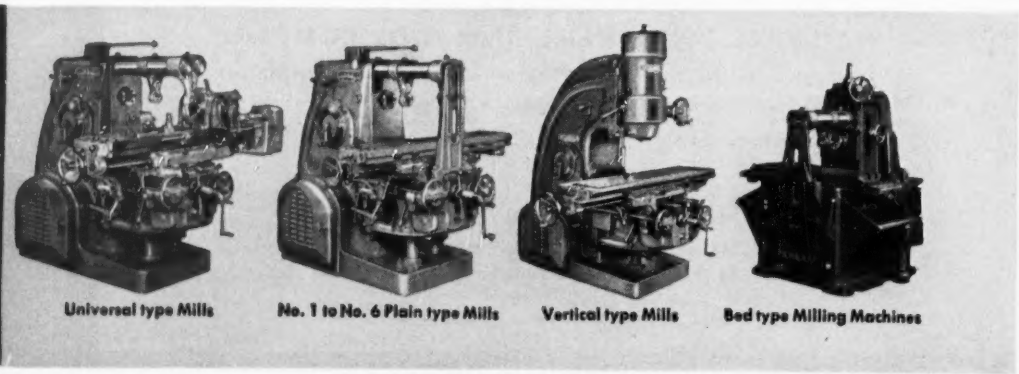
. . . for all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs, and Special Tools

Announcing

KEARNEY & TRECKER'S TOOL-LEASE PROGRAM

The most significant opportunity ever offered machine tool users!

Here are a few of the many new Kearney & Trecker machines available for Tool-Leasing



Universal type Mills | No. 1 to No. 6 Plain type Mills | Vertical type Mills | Bed type Milling Machines

NOW... you can rent new Kearney & Trecker machine tools!

Here's what that means to you—

TOOL-LEASE ALLOWS YOU TO—

- ✓expand production without tying up working capital
- ✓stay free of long term investments
- ✓remain debt free
- ✓avoid the risk of high obsolescence
- ✓be unrestricted by creditor's limitations
- ✓keep future borrowing capacity unimpaired
- ✓simplify your financial structure
- ✓obtain optimum efficiency, flexibility and capacity to meet constantly changing production requirements.
- ✓try out, in effect, new machines... without having to buy them

TOOL-LEASE HELPS YOU GET THE EXACT TOOLS FOR THE JOB—

Under Kearney & Trecker's Tool-Lease Program, you may obtain any standard Kearney & Trecker machine tool. This includes: standard knee-type and bed-type milling machines and precision boring machines. Special lease agreements will be considered where either special machinery or applications of heavy-duty CSM bed-types are required.

TOOL-LEASE GIVES YOU 3 PLANS TO CHOOSE FROM—

The basic Tool-Lease Program gives you a choice of three plans with varying options to terminate the lease, continue the lease or purchase the equipment. Depending upon the plan selected, equipment may be leased for one, two or three or more years.

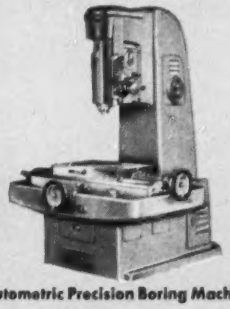
Your Kearney & Trecker representative will be pleased to give you specific Tool-Lease information and help you analyze your machine tool needs... suggest the equipment that will best help you solve your production problems. Write, wire or phone Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®

©1954

Fill out and attach coupon to your letterhead and mail for Tool-Lease Bulletin.

Rotary Head Milling Machines



Automatic Precision Boring Machines

Kearney & Trecker Corporation
6784 W. National Ave.
Milwaukee 14, Wis.

Please send me Bulletin TL-10A with details on the Tool-Lease Program.
☐ Check here if you would like to have a representative call on you as soon as possible (or call Milwaukee, GReenfield 6-8300).

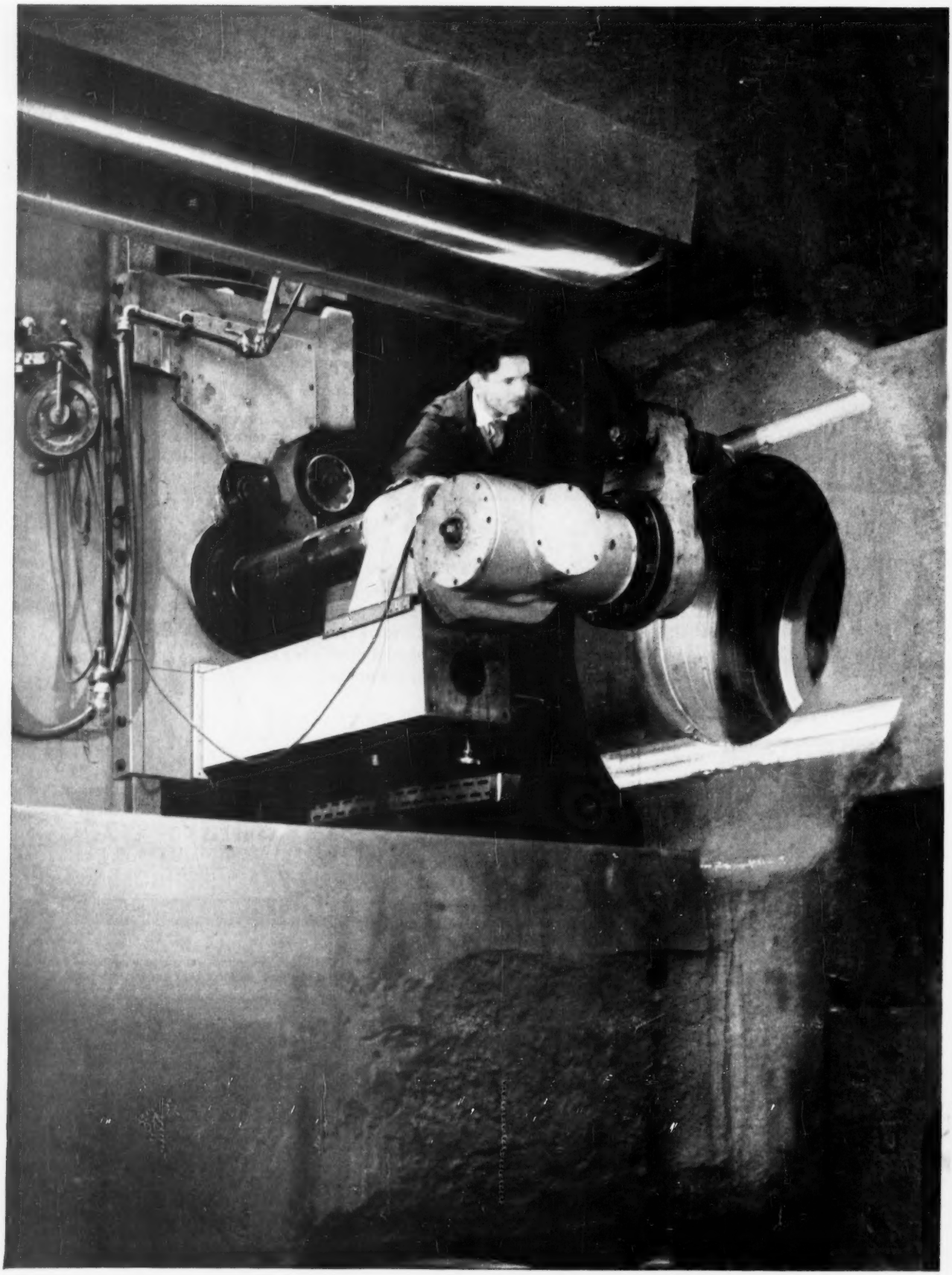
Name .....

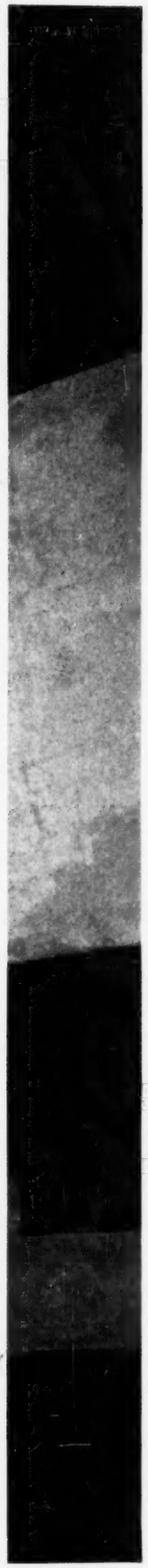
Title .....

Company .....

Address .....

City ..... Zone ..... State .....





Beauty treatment...

for a 100-ton steel giant

Here's exceptional extra capacity that minimizes handling, setup and job time on huge castings or weldments. It's a G&L 50 Series floor type Horizontal Boring, Drilling, and Milling machine with an underarm spindle support.

Now, with a G&L 50 Series Horizontal Bar, you can provide the extra capacity to speed normal production or to simplify work on castings as big or bigger than the 100-tonner illustrated.

These superb machines, with underarm spindle supports, make it easy for you to mill, face, turn and bore with equal proficiency . . . in a single setup! Furthermore, the underarm support allows you to work at right angles to the spindle, as far as 60" from the headstock and still maintain close tolerances, flatness and parallelism.

50-Series machines, with either a 6" or 7" main spindle, mount six different attachments on the underarm. Among these capacity-boosting tools are continuous feed facing heads and angular and off-set milling heads for accurate work on limited access surfaces.

For complete information on 50 Series machines — table, floor and planer types — contact your G&L representative or write for Bulletin N-1.

GIDDINGS & LEWIS MACHINE TOOL CO.

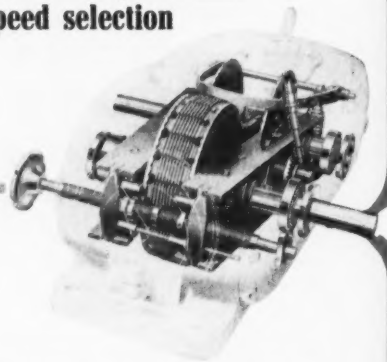
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

WHY ALL industry uses P.I.V.

LINK-BELT's P.I.V. provides positive, infinitely variable speed selection

ALWAYS POSITIVE



ALWAYS STEPLESS

WHEREVER speeds must be varied—instantly, exactly, positively—you'll find Link-Belt's P.I.V. at work. Here's a variable speed drive that operates independent of friction. Exclusive self-tooth-forming chain meshes with grooved wheels, transmits power with no wasteful slip.

Without stopping the machine, you can select the speed you need—from maximum to minimum settings. And at any speed, full-rated horsepower is delivered.

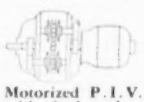
If there's a process in your plant that requires precise speed selection, get all the facts about compact, all-metal P.I.V. Write for Catalog 2274, or call your nearest Link-Belt office or distributor. 12.431

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

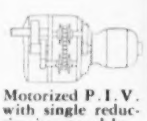
P.I.V. LINK-BELT
P.I.V. VARIABLE SPEED DRIVE
4 of 16 P.I.V. types, ½ to 25 hp — ratios to 6:1

Basic P.I.V. Like all others, it is built for horizontal or vertical mounting.

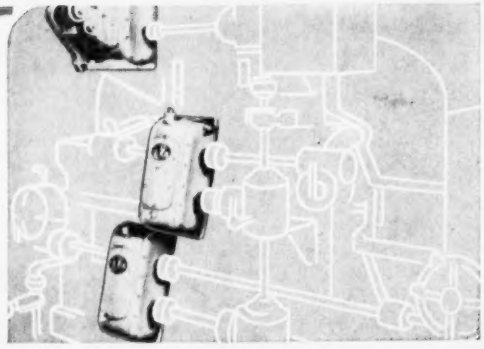
P.I.V. with single reduction input or output helical gears.



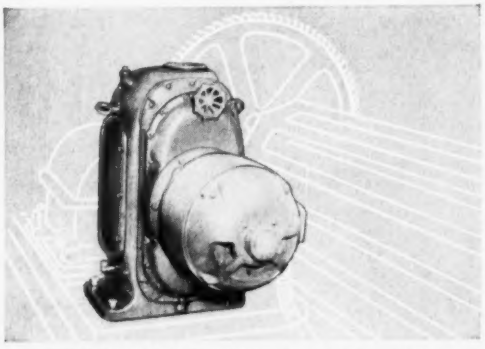
Motorized P.I.V. with single reduction input and output helical gears.



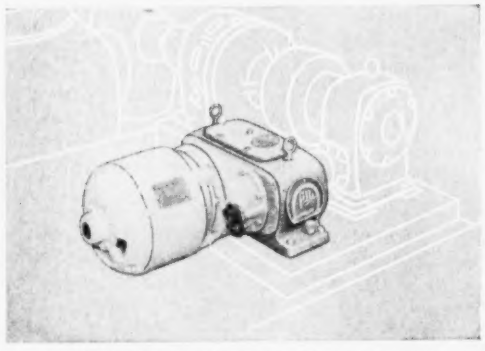
Motorized P.I.V. with single reduction input and double reduction output helical gears.



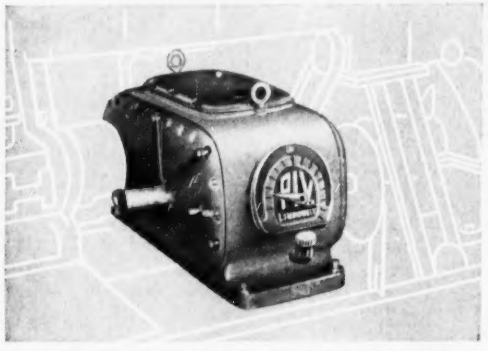
POSITIVE OPERATION OF DIFFERENTIAL SPEED EQUIPMENT. P.I.V. also provides precise regulation of rotary motion.



FLEXIBILITY IN TIMING. In addition, P.I.V. offers accurate control of processing speeds, unaffected by atmospheric conditions.



STEPLESS CONTROL OF PRODUCTION LINES OR INDIVIDUAL MACHINES, either manually or automatically, positively, dependably.

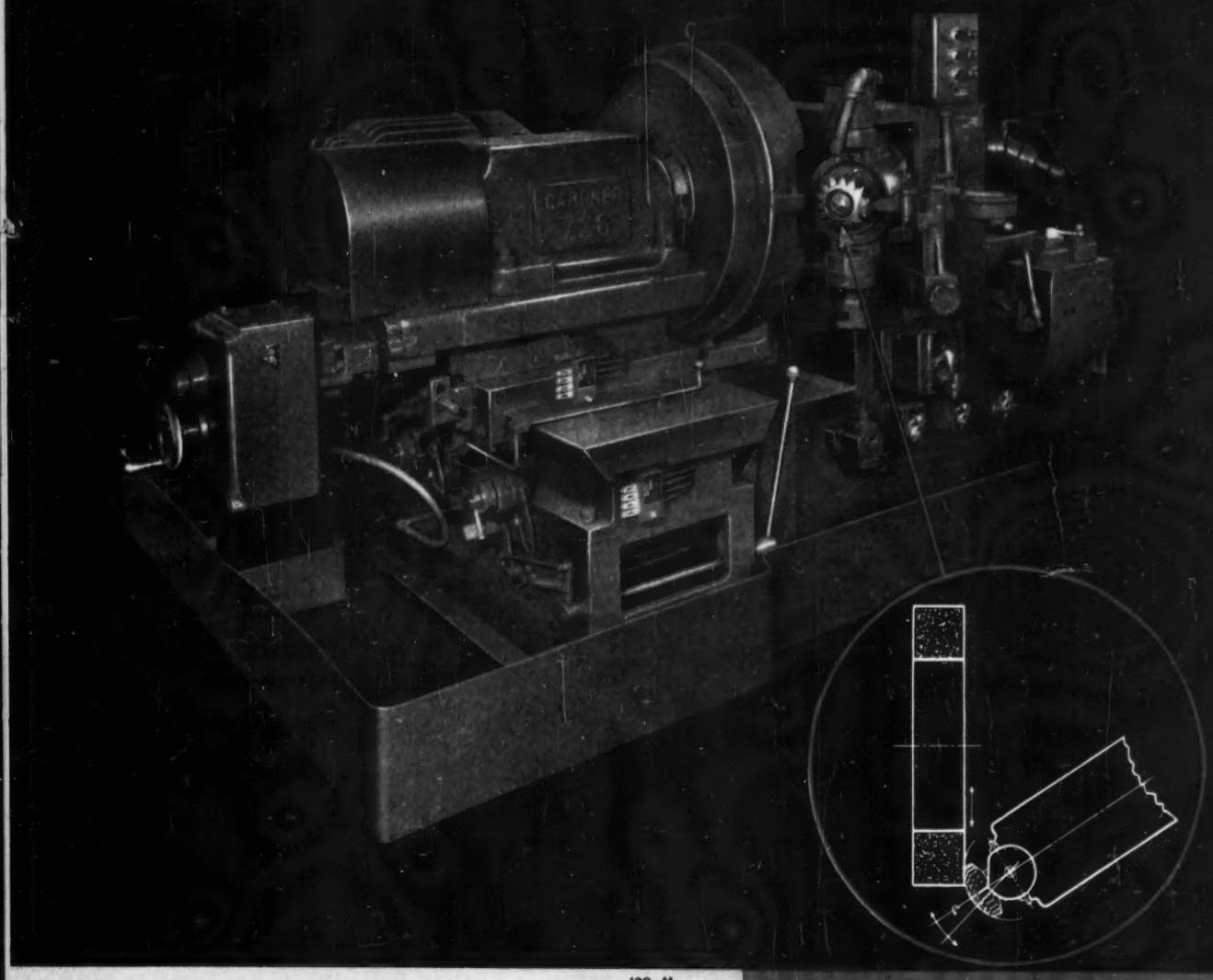


EXACT SYNCHRONIZATION OF ROTATING PARTS AND MACHINES. P.I.V. is needed where automatic sequence control must be stepless.

For more information on products advertised, use Inquiry Card, page 247

NEW DISC GRINDING METHOD GENERATES CURVED SURFACE

Production of rock-bit side cutters speeded by Gardner tooling



130 M

JOB DATA	
MACHINE	Gardner 726-26" Single Spindle Grinder
TOOLING	Hydraulically oscillating work carrying fixture with hydraulic work clamping
ABRASIVE	26" x 3" x 16" disc—Gardner Wire-Lokt®
PRODUCTION	45 pieces per hour of spherical surface on rock-bit side cutter; formerly ground straight
TOLERANCE	.010" for uniformity
STOCK REMOVAL	Approximately 1/4" of hard surfaced steel stock

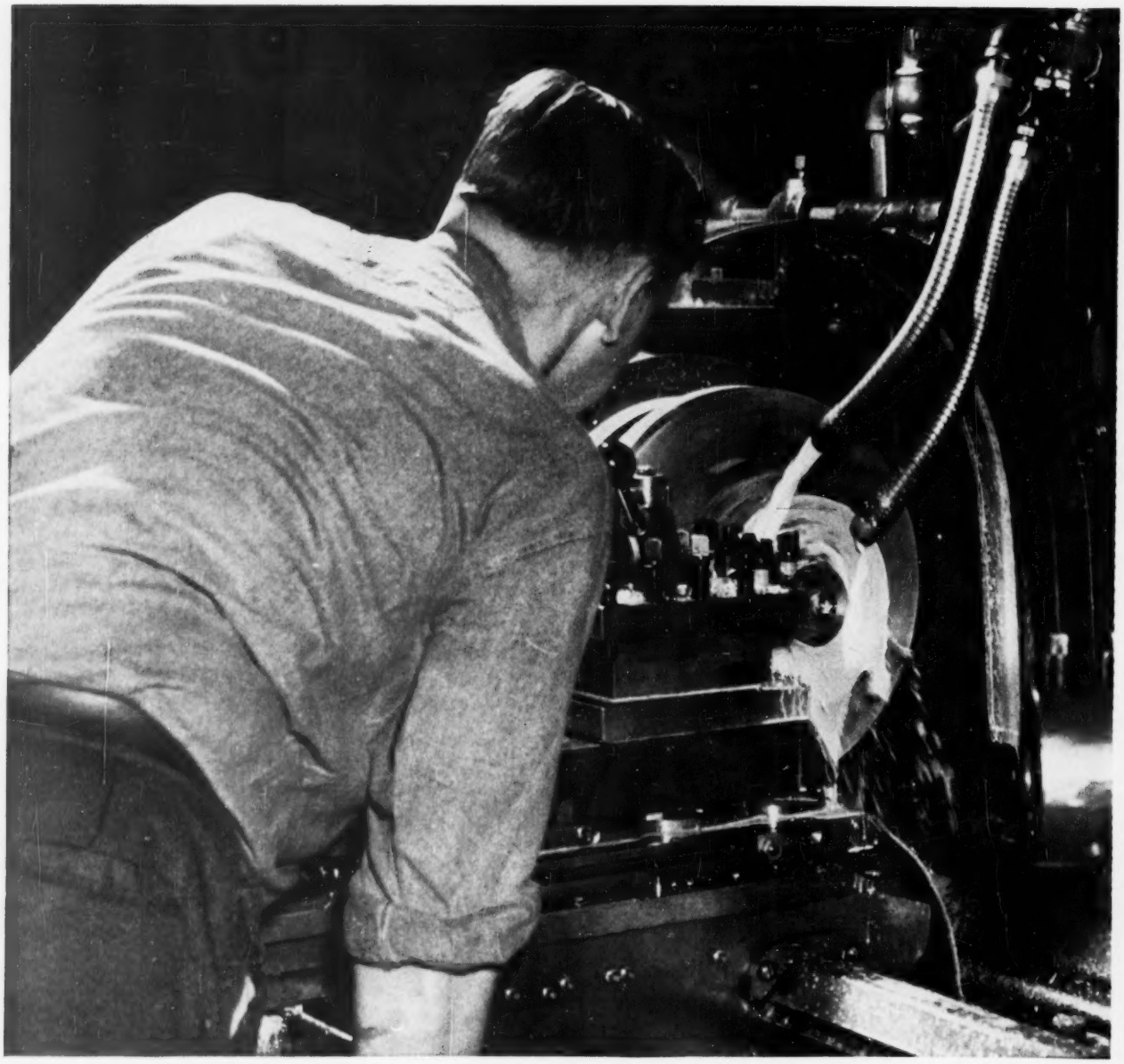
For assistance with any kind of surface grinding problem, send us blue prints for production estimates and tooling suggestions.

GARDNER MACHINE COMPANY

414 Gardner St., Beloit, Wisconsin, U.S.A.

GARDNER

precision disc **Grinders**



Built right– Sold right

• Warner & Swasey Machine Tools have established enviable records for high productivity, low maintenance and minimum downtime. They've *proved* their dependability – holding their accuracy for years after they have paid for themselves. They're *built right!*

Warner & Swasey's principle of design plays an important role in this success. Each model is *individually designed* – from the floor up – to handle a *specific range of work.* Machine handling time is thus minimized.

Skilled craftsmen, working to exacting

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

Warner & Swasey standards, combine the most modern machines and processes with certain time-honored hand techniques . . . so necessary to insure the traditional Warner & Swasey accuracy.

And Warner & Swaseys are *sold right!* By turning specialists who follow a rigid Warner & Swasey policy—that they recommend and sell a machine *only* when it completely fulfills the requirements of your particular work.

These turning specialists are also at your service long *after* the order is written. Your nearest resident Field Representative, one of 47 located throughout the country, is quickly available to you. He's ready to lend his training and experience to help you *maintain* the high productivity of the Warner & Swaseys in your plant.

So whatever your turning needs—whether it's a machine for a specific job, or if you're looking for greater production through modernization . . . call in your nearest Warner & Swasey Field Representative.

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

Fairbanks-Morse saves floor space,

In machining electric motor shafts, Fairbanks-Morse uses a Hydra-Trace attachment mounted in place of the compound rest on a LeBlond 16" Heavy-Duty Engine Lathe. This shaft is machined from 3¼" 1245 steel bar stock. Rough and finish cuts are run at 318 rpm (average, 325 sfm) with the feed set at .0168 ipr. .012" to .015" surplus stock is left for finish grinding.

slashes tool costs with Hydra-Trace*

LeBlond Lathe plus Hydra-Trace replaces two automatics—machines 55 different shafts in lots of 25 to 150.

Before Hydra-Trace, F-M produced its motor shafts on a pair of automatic lathes. Each turned one end of the step shafts; each used seven tools and two tool blocks. Frequent set-up changes—*each requiring eight hours*—more than ate up the time saved by automatic production.

Then Fairbanks-Morse consulted our Chicago office, purchased a 16" Heavy-Duty Engine Lathe equipped with Hydra-Trace. Here are the results:

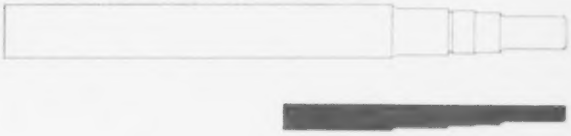
Set-up time became Production Time. Hydra-Trace setup per shaft end takes only 15 minutes—for a total of 30 minutes. Result—7½ former setup hours became available for production.

Floor space saved. One machine does the work of two. (Overall average production is equal.)

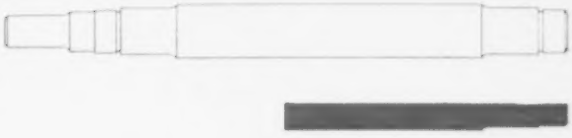
Tool costs slashed. Two tools replace 14. Tool life increased 33%.

Storage problem simplified. Hydra-Trace templates are flat, easily made, much simpler to store and locate than bulky tool blocks (or master shafts).

Hydra-Trace can replace the compound rest of virtually any LeBlond lathe built since 1935. And operators of only average skill can easily operate this heavy-duty, hydraulic tracer.



A typical shaft-turning operation—Hydra-Trace automatically follows template 1 as first-phase rough and finish cuts are taken on one run of shafts.



Then, the shaft ends are reversed. The second template is set and the second machining phase completed.

Whether you are cutting step shafts, contour facing or turning forms—a LeBlond Heavy-Duty Lathe with Hydra-Trace will prove the most versatile, the most dependable machine in your shop. You can use it as a duplicating lathe on production runs; then, in minutes, replace the Hydra-Trace attachment with the standard compound rest for regular work.

For more information on LeBlond Heavy-Duty Lathes, see your nearby LeBlond distributor or write—

THE R. K. LEBLOND MACHINE TOOL CO. CINCINNATI 8, OHIO

Write for Bulletin HT-4D
for the complete Hydra-Trace story.

*TRADE MARK, REGISTERED U. S. PAT. OFF.

turned faster by

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • FOR MORE THAN 64 YEARS

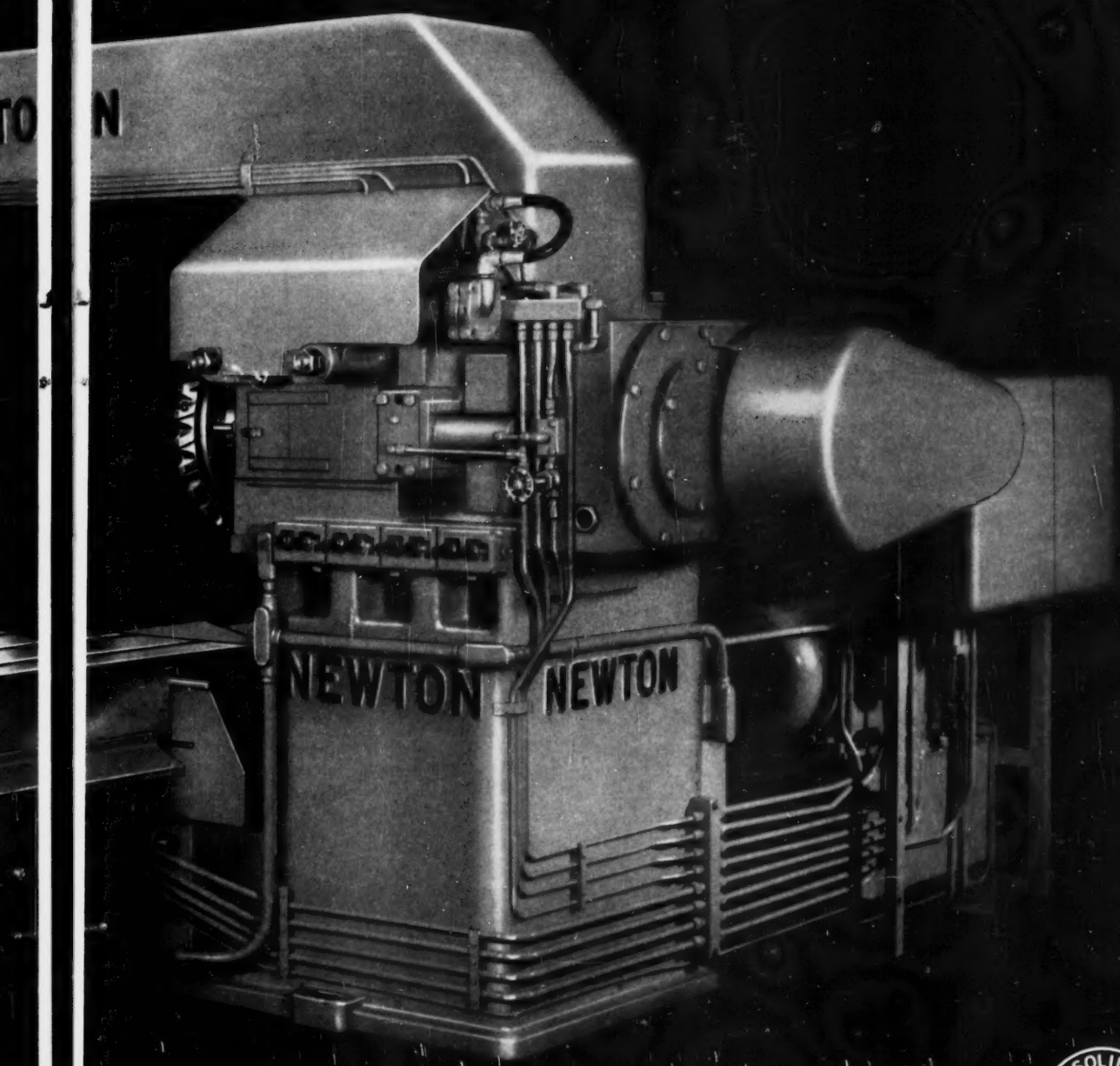
. . . as good

Newton M-59 Duplex Unit-Head Milling Machine with hydraulic spindle retraction and clamping that *accomplish stock removal and high quality finish in one pass!*

CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-

as it looks!

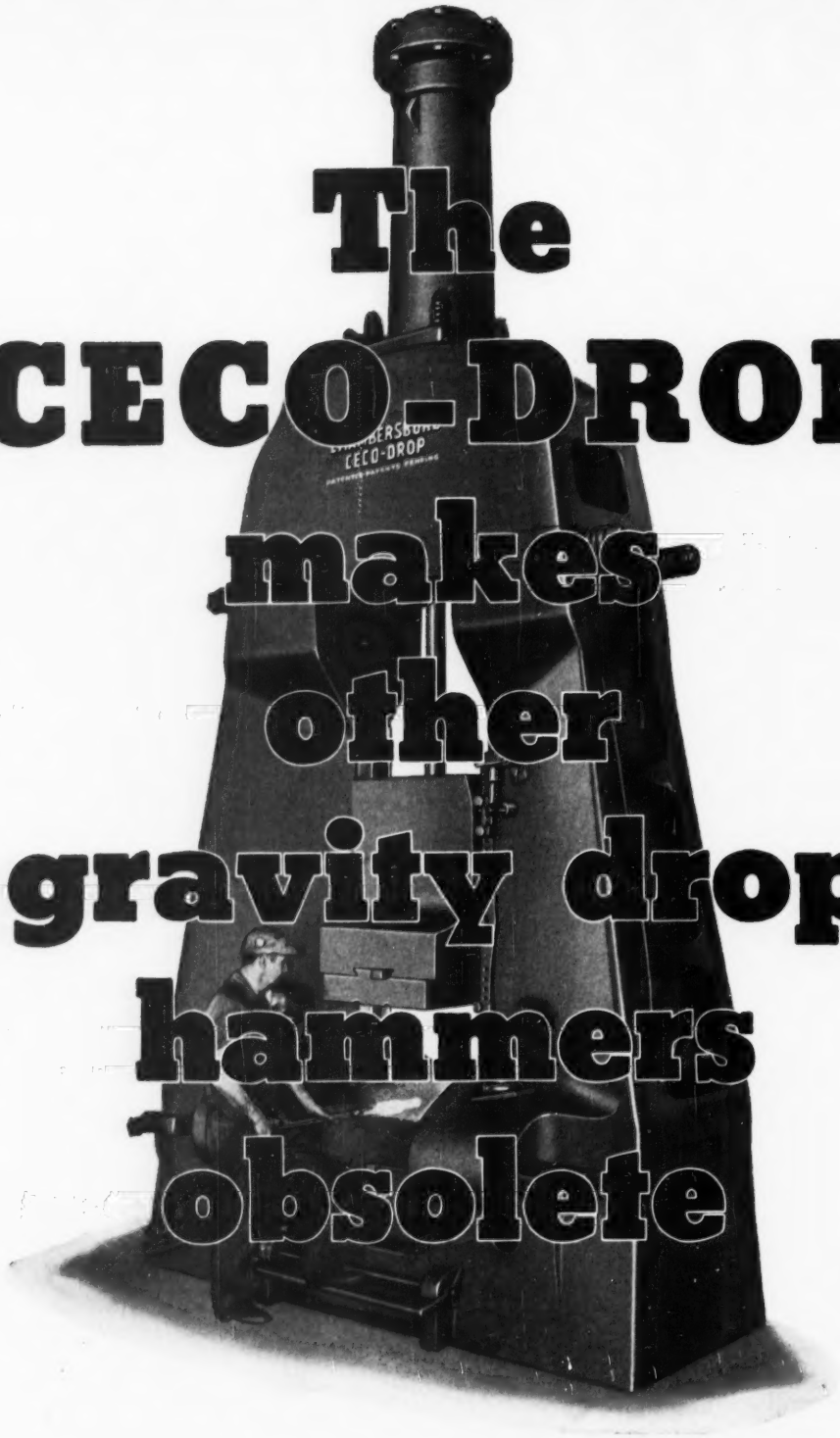


CONSOLIDATED MACHINE TOOLS

CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated

The CECO-DROP makes other gravity drop hammers obsolete



Builders of THE IMPACTER

"FORGING IN MID-AIR"

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

For more information on products advertised, use Inquiry Card, page 247

DAILY NEWS
JANUARY 15, 1954
FIVE-STAR EXTRA
IMPORTANT DISCOVERY MADE IN SCIENTIFIC TESTS OF CIMCOOL
CINCINNATI, O.—Laboratory and shop tests have now established that Cimcool with "95-61", doubles rust-control as compared with a formula without this amazing ingredient.

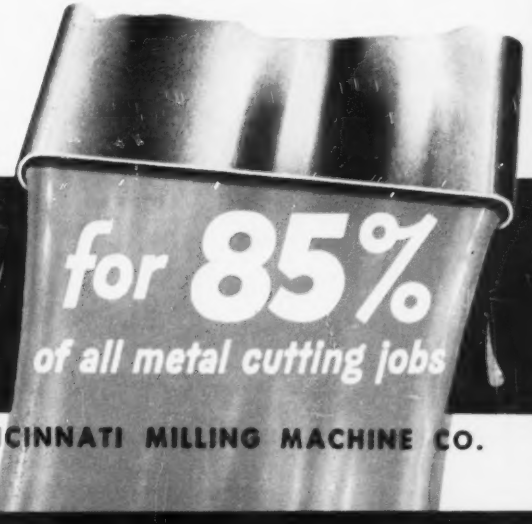
Tests Prove That CIMCOOL With "95-61" Doubles Rust-Control

It's true! Actual scientific laboratory and shop tests prove that adding "95-61" to CIMCOOL® doubles rust-control as compared with a formula without this amazing ingredient.

But doubling rust-control is *only one of many ways* that this radically new and different coolant—this *chemical emulsion*—saves you money. Plant after plant reports that CIMCOOL covers 85% of all metal cutting jobs . . . and does a better job. It permits faster speeds because it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants. It's longer lasting in machines. So CIMCOOL reduces downtime and cuts labor costs for cleaning and changing.

Prove to yourself what scientific tests and on-the-job experience have already proved. Put CIMCOOL to the test in your own plant—on your own machines. For a demonstration, write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.



CIMCOOL

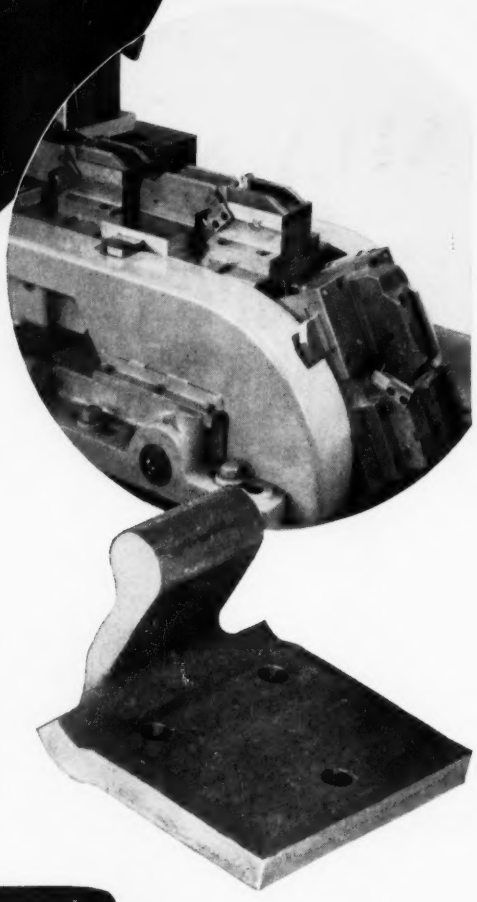
for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

lower cost per piece . . .

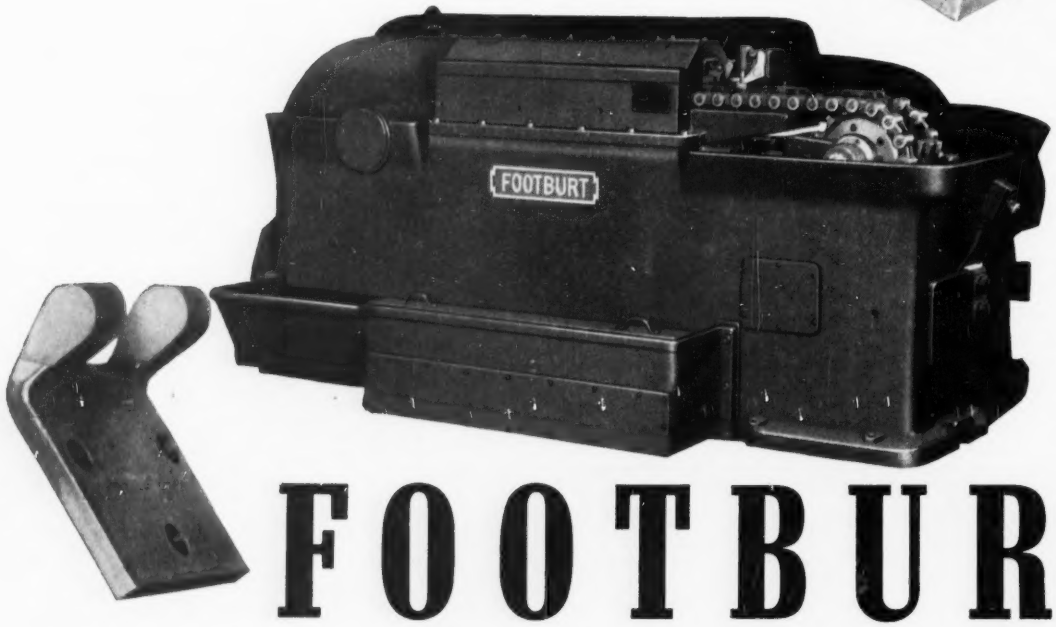
with continuous surface broaching of small parts

• Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.



• In many plants where large quantities of duplicate metal parts are being machined substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching in many fields.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building



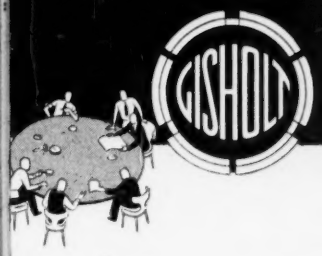
FOOTBURT

PRODUCTION MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 247

Production Pointers from GISHOLT

GISHOLT TIME-SAVING IDEAS



Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

TWO OPERATIONS ON ONE MACHINE...WITH ONE SETUP

Fastermatic Double-Chucks Part

This is a bit tricky, but note how these couplings are produced without tying up two machines or running up increased costs through needless changeover time.

The part requires two machining operations; two chuckings. The problem of how to do it on one machine using *one* tool setup was solved with a 2F Fastermatic Automatic Turret Lathe.

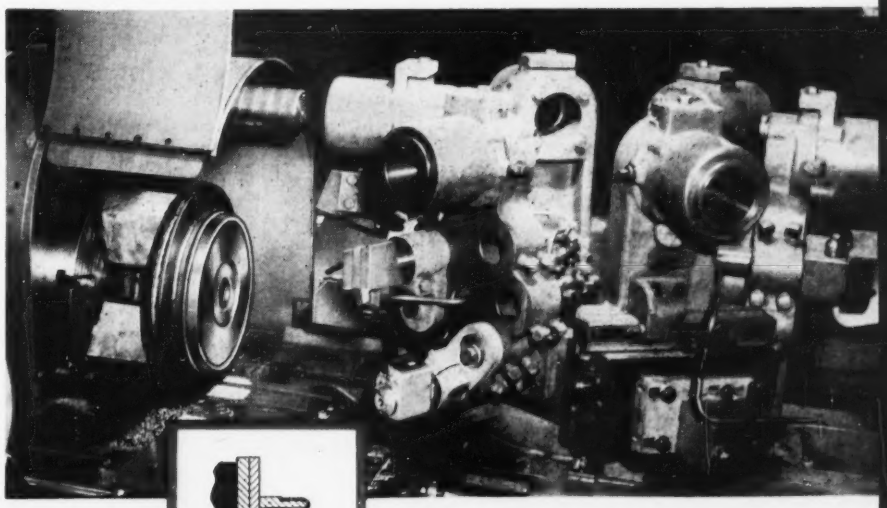
Here's how:

Operation 1—this consists of turning, facing, boring and chamfering from turret stations 1—2—3. The part is held in the ID with an air chuck. With this automatic cycle completed, the spindle stops and the workpiece is turned around and rechucked in the same jaws—except that now they hold on the OD.

Second Operation—the machine is started and automatically goes through the new machining cycle. Turret stations 4—5—6 rough and finish face on the other side, completing the part.

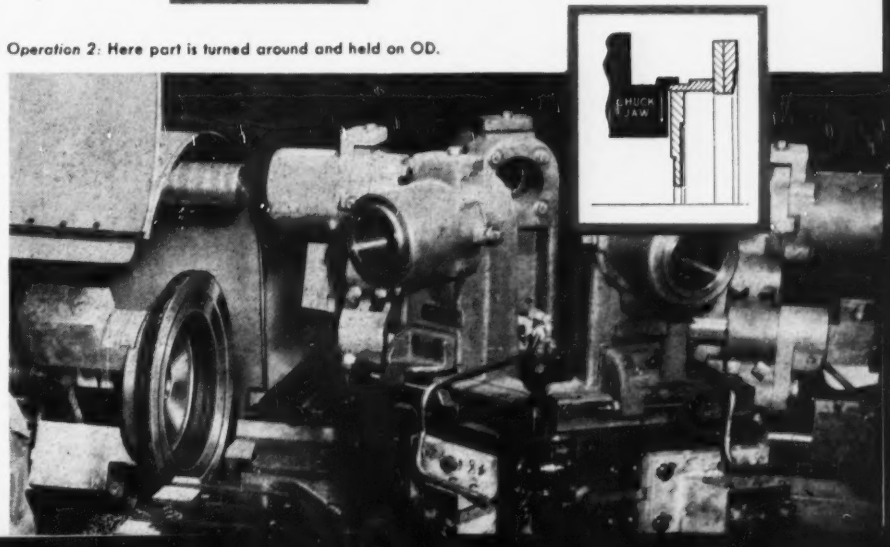
Obviously, this single-tooled, switch-around idea is not applicable in many cases. Yet, it is worth remembering. And so is the unusual versatility of the Fastermatic Automatic Turret Lathe which can account for reduced machining time and costs on many jobs.

The Fastermatic Automatic Turret Lathe does this unusual job easily and fast with both operations handled in one setup.



Operation 1. Working from turret stations 1—2—3. Note here part is held in ID.

Operation 2: Here part is turned around and held on OD.



TIME-SAVING IDEAS

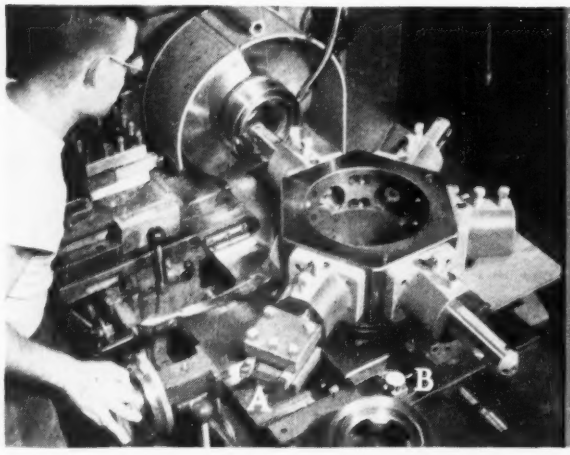
REDUCING TOOL COSTS ON DOUBLE-OPERATION WORK

C/F Turret Permits Simpler Tooling on Saddle Type Lathe

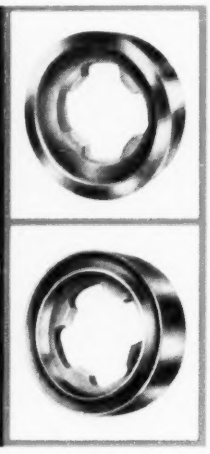
Here's a case where the producer wanted to handle first and second operations on one machine and do it with the simplest, most inexpensive possible tooling. The part is a 7½" commutator clamp. A Gisholt 1L Saddle Type Turret Lathe was given the job because there is considerable stock removal... and because it could be equipped with a cross-feeding hexagon turret to simplify tooling.

The drawing shows the surfaces machined in the two operations. Short flanged tool holders on the hexagon turret permit changeover in just minutes. The photo shows the setup for the second operation. Note the standard turret tool holder (A) which holds two cutters to finish the two faces of the outer rim. The cross-feeding turret handles both in one pass. This saves time and it insures dimensional accuracy.

One bore has a particularly critical diameter. Setting the hexagon turret cross slide with the dial indicator (B) insures the precise dimension.

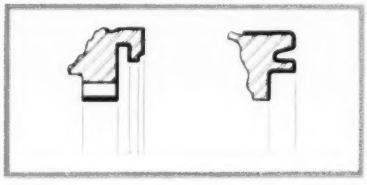


Machine view showing second operation.



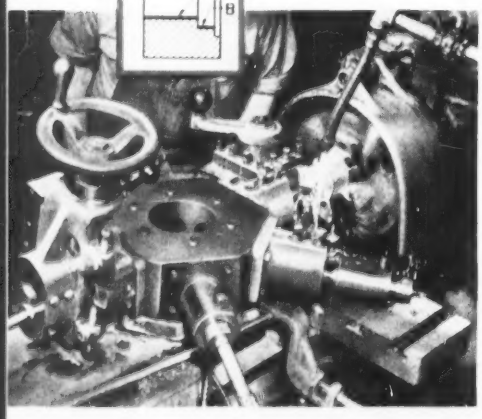
Finished piece, first and second operation.

Another example of how the cross-feeding turret on the Gisholt Saddle Type Turret Lathe can save time and reduce tooling costs on a variety of work.



A SIMPLE JOB MADE EVEN SIMPLER

Quick Change of Spindle Speeds Saves Time, Effort, Money

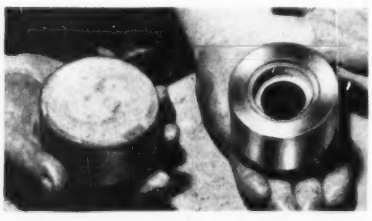


Working at 402 r.p.m., the operator will get reaming speed by merely tapping the HI-LO lever, shown below.

This would be a simple enough job in any shop. But here, the important differences in time and effort show up with the operation of the ram type machine. With the No. 5 Ram Type Turret Lathe, equipped with the Gisholt Hydraulic Speed Selector and HI-LO Trip Lever, time and effort are reduced to the barest minimum.

The reasons: (A) is first drilled and then bored from the hexagon turret. This work is done at 402 r.p.m. Then reaming is done. Here, with most machines, the operator would have to shift headstock gears to the new and lower spindle speed. With the Gisholt No. 5 Ram Type Turret Lathe, the operator just taps the HI-LO lever. Instantly the Hydraulic Speed Selector makes the shift. Even before the reamer is in working position, the spindle is turning at the correct speed—69 r.p.m. in this case.

Once the reaming is done, the operator again trips the HI-LO lever; and while the turret is indexing, the Hydraulic Speed Selector automatically makes the shift back to 402 r.p.m. Then counterbore (B) is started.



Rough workpiece and completed part.

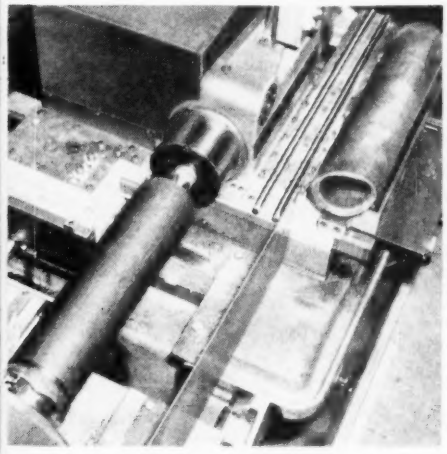
The Gisholt Hydraulic Speed Selector not only saves time and physical effort in changing speeds, but it also reduces floor-to-floor time. That's another good way to cut costs.

GISHOLT

TIME-SAVING IDEAS

SMART LOADING METHODS LIKE THIS WILL SAVE YOU TIME

Simplimatic Automatic Lathe Uses Slide to Aid Handling



With part completed, it is moved out on the rails and then onto the conveyor lines. New workpiece then is rolled onto the rails and pushed on arbor. Sketch below shows complete sequence.

This was not a matter of faster cutting, but faster "handling time." The workpiece is a 155 mm steel shell body. The machine is the Simplimatic Automatic Lathe. The job itself is simple: face down to the boss and cut off to length.

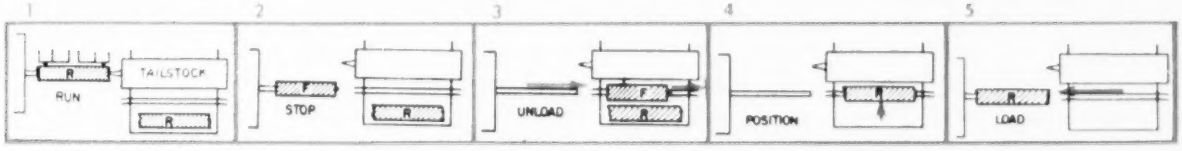
Most interesting is the expert work-handling method—a simple device that greatly increases machine use and hourly production by reducing loading and unloading time.

Step by step, the job goes like this: the slide with tailstock is retracted. Rails mounted on the slide guide the rough workpiece as it is loaded on the arbor. The slide then moves forward and the tailstock quill supports the work.

While the rear tools make chips, the operator places a new rough workpiece on the ramp at the front of the slide. With machining completed, the tailstock quill automatically retracts and the slide moves back. The finished part is moved off the arbor onto the rails and then to a conveyor line. Onto the rails goes the waiting rough workpiece and then on the arbor. The tailstock slide comes into position; the next piece is begun.

This job could easily take 20% to 40% longer without this efficient handling arrangement—even with the same machining time. Gisholt engineers have had extensive experience in solving loading problems. Let them help save time on your jobs of this kind.

The tailstock slide on this Simplimatic also carries loading-unloading rails which quickly position the work and ease the manual burden.



ALUMINUM IMPELLERS GET FAST MACHINING

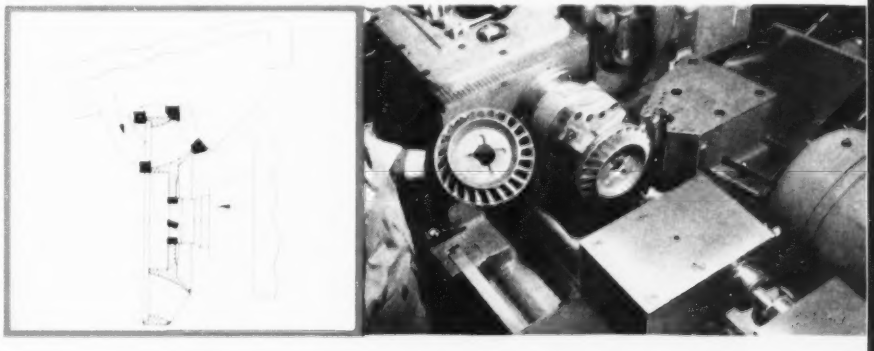
No. 12 Hydraulic Automatic Lathe does it in 10 Seconds

Split-second efficiency is a must on this job—machining operations on two different impellers for a popular car's automatic transmission. While the work is small, the volume is great. So, every second counts.

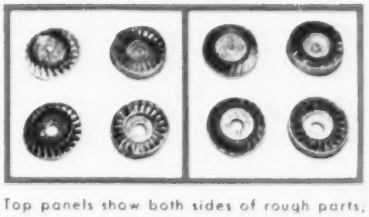
Only one No. 12 Hydraulic Automatic Lathe is needed to handle the entire output. With the workpiece located in the 3-jaw air chuck, the spindle is driven at 900 r.p.m. The workpiece center is then removed by trepanning under oil mist lubrication. A speeder drives the trepanning cutter by means of a sliding sleeve arrangement on the front carriage. Longitudinal carriage movement carries the cutter to and from the work, allowing clearance for loading.

The balance of the work is done with four tools in a single tool block on the rear slide. This slide moves in at an angle so that both back faces may be shaved at once.

Time is just ten seconds floor-to-floor. The No. 12 Hydraulic Automatic Lathe performs with speed and economy on all jobs working with all metals. It can give you the high production and low cost you want in your work.



The flexibility of the No. 12 Hydraulic Automatic Lathe permits the kind of tooling which reduces this job to only two simultaneous straight-line motions.



Top panels show both sides of rough parts; the completed parts are below.

Write for complete catalog of No. 12 Hydraulic Automatic Lathe.

GISHOLT

TIME-SAVING IDEAS

CYLINDRICAL PARTS BALANCED IN OVERHANGING POSITION

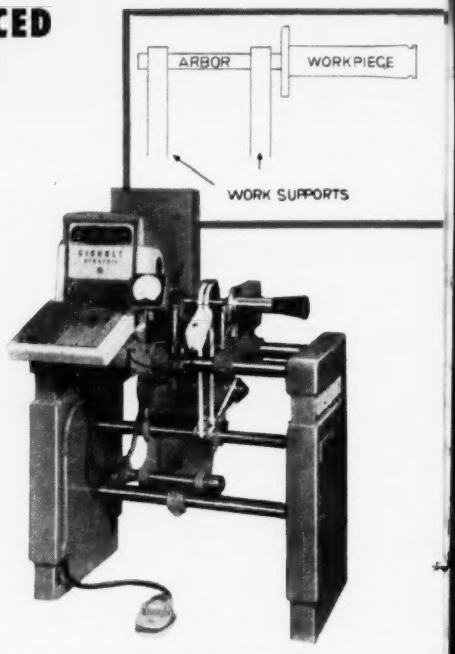
Improved 1S DYNETRIC Balancer Simplifies and Speeds up Two-Plane Balancing

The spinners used in textile mills must be dynamically balanced because of their high-speed rotation. Here, a rayon spinner, a workpiece typical of those which do not carry their own shaft, is being balanced on the Gisholt improved type 1S DYNETRIC Balancing Machine. The spinner is mounted on an arbor and balanced in an overhanging position. This simplifies loading and unloading since the arbor is not removed from the work supports. Simple left or right switches simultaneously indicate the location and amount of material to be removed in each correction plane. Correction is made after removal from the arbor. Production balancing of overhanging workpieces such as this is a simple operation on Gisholt Balancing Machines. Unbalance is quickly and accurately measured and located for correction.

The machine-mounted arbor permits balancing of overhanging parts and speeds up loading and unloading.

NEW CATALOG covers the improved and more complete line of Type S DYNETRIC Balancing Machines. It has full information and illustrates many interesting jobs. Write for your copy.

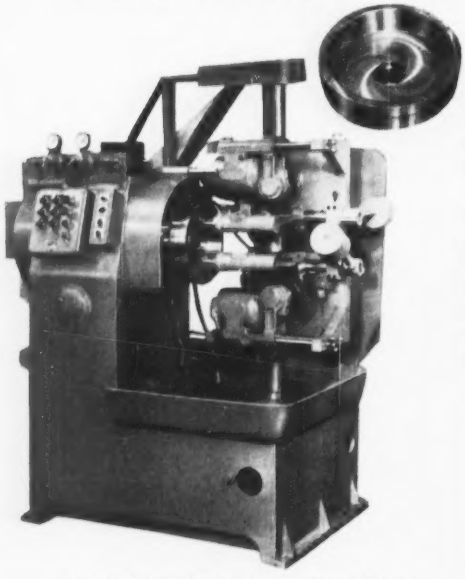
DYNETRIC BALANCERS



Improved Type 1S DYNETRIC Balancing Machine with loaded workpiece. Drawing shows permanently mounted arbor on work supports.

AIR CYLINDERS GREATLY IMPROVED BY SUPERFINISHING

ID Surface Handled in One Quick, Automatic Operation

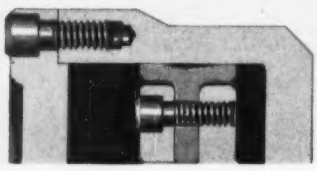


Model 79 Superfinisher showing stone holders in working position. Above, part ID is Superfinished; reflections are from true base metal.

This is one of our own applications of Superfinish. The part is the air cylinder used with Gisholt air-operated chucks.

To give maximum efficiency to these cylinders, we turned to the practical expedient of Superfinishing. The result is an ID surface that allows far less blow-by, and that greatly extends packing life. At first the parts were Superfinished in our Superfinishing laboratory. Then, to do the job on a production basis, a special automatic machine was designed, the Model 79 Superfinisher. It has large capacity with variable speeds and oscillation rates. For rapid loading and unloading, it is equipped with an air chuck.

In one fast, automatic operation all Gisholt air cylinders are Superfinished to make them better performing, longer serving.



Superfinish of the ID reduces blow-by and increases packing life.

SURFACE FINISH—its problems and how they are overcome by Superfinishing are fully covered in new catalog. Write for your copy now.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

No. 3-454

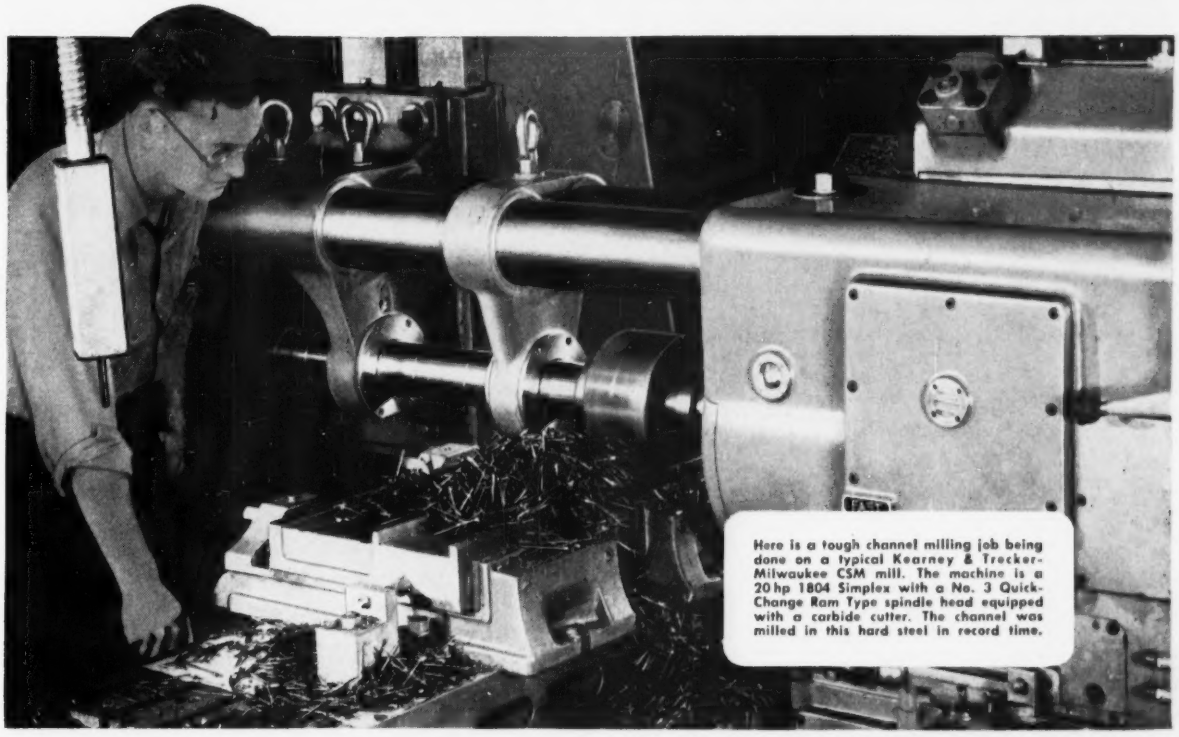
624

Write for your copy of Gisholt's new general catalog.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Put your milling on a profitable production basis



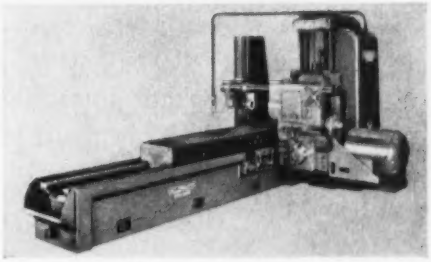
Here is a tough channel milling job being done on a typical Kearney & Trecker-Milwaukee CSM mill. The machine is a 20 hp 1804 Simplex with a No. 3 Quick-Change Ram Type spindle head equipped with a carbide cutter. The channel was milled in this hard steel in record time.

Choose a CSM BED TYPE production mill from over 400 available combinations!

FOR more efficient metalworking, investigate the most modern and useful line of bed-type milling machines ever designed. Custom-built from standard units, CSM machines are available in 10 to 50 hp, Simplex and Duplex models with a choice of quill type or ram type heads. Tables are available in four standard widths — 18, 24, 32 and 42" — with travels from 4 to 12'. Rapid traverse rate is 150" per min., and 32 feed rates range from ¼ to 60" per min. You can choose from a wide range of attachments and accessories to meet your exact tooling needs.

Your Kearney & Trecker Special Machinery representative will be pleased to give you all the details . . . help analyze your machine tool requirements.

Capacity . . . Experience . . . Performance — In our just completed $5,200,000 expansion of our Special Machinery Division, we offer you (1) unmatched facilities, (2) experience based upon more than 50 years in the design and production of special machinery, and (3) performance, best recommended by our outstanding record of successfully solving many hundreds of unusual machining problems.

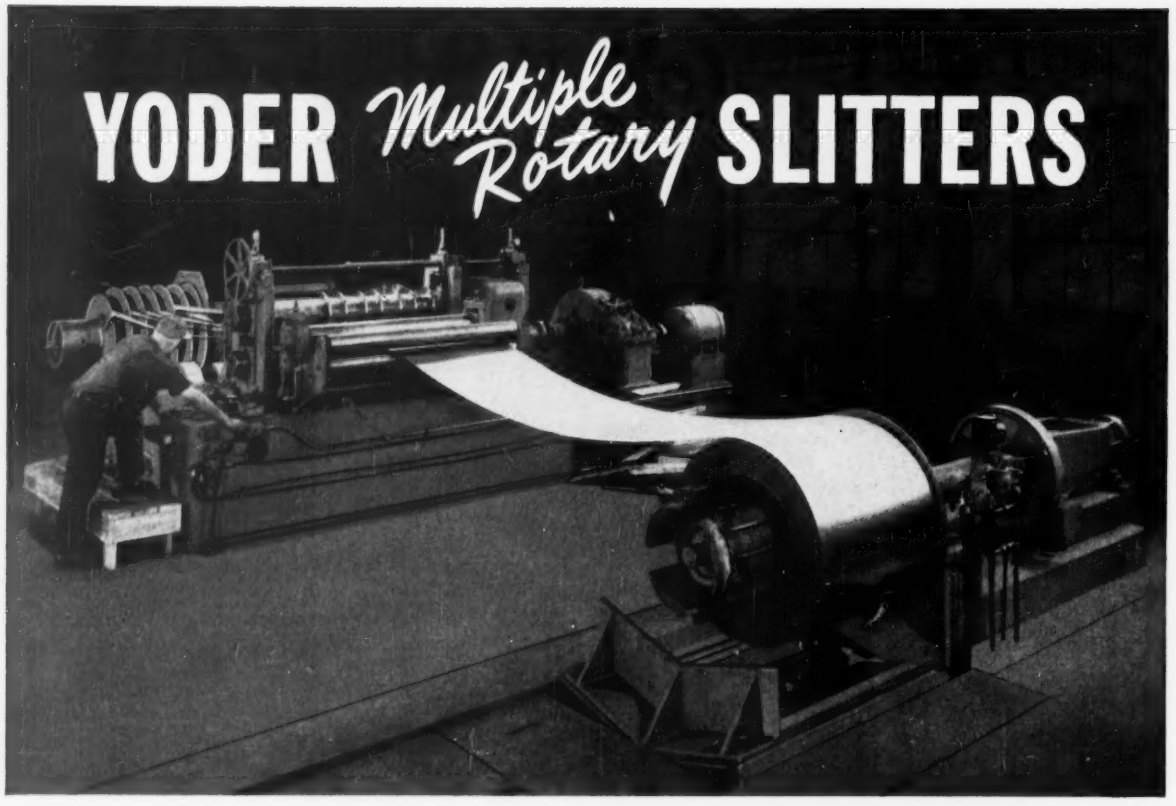


Here is a 50 hp CSM Simplex Milling Machine with a No. 5 Quick-Change Ram Type Head.

Our complete line of CSM milling machines is described and illustrated in detail in this big 20-page catalog. For your copy write to Kearney & Trecker Corp., Special Machinery Division, 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER CORP. · *Special Machinery Division*
MILWAUKEE 14, WIS., U. S. A.

YODER *Multiple Rotary* SLITTERS



pay Four Kinds of Dividends

If you use 100 tons or more of coiled strip or sheets per month, in special widths, the installation of a Yoder Slitter will pay four kinds of dividends:

1. Savings of $10 to $30 per ton by buying standard widths instead of slit strands. This saving alone often pays for the Slitter investment in a year or less.

2. You can buy standard widths competitively, wherever you can obtain the best quality, price and delivery.

3. Greatly reduced inventory requirements. From a relatively small stock of standard widths you can meet your own needs for special widths in a few hours.

4. Better control of production schedules since slitting service no longer is a problem.

Yoder slitters, uncoilers, recoilers and other accessories are made in many sizes and capacities, from the smallest to the largest. The Yoder Slitter Book is a treatise on the economics as well as mechanics of slitter operation—send for it.

THE YODER COMPANY • 5504 Walworth Ave., Cleveland 2, Ohio

Complete Production Lines

- ★ **COLD-ROLL-FORMING and auxiliary machinery**
- ★ **GANG SLITTING LINES for Coils and Sheets**
- ★ **PIPE and TUBE MILLS–cold forming and welding**

ENGINEERING YODER MANUFACTURING

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Farval saves 50 minutes of each lubricating hour on Clearing press

FARVAL—*Studies in Centralized Lubrication*
No. 150

GOOD news for cost-conscious management! Lubrication studies show that Farval saves 50 minutes out of every hour of oiling labor.

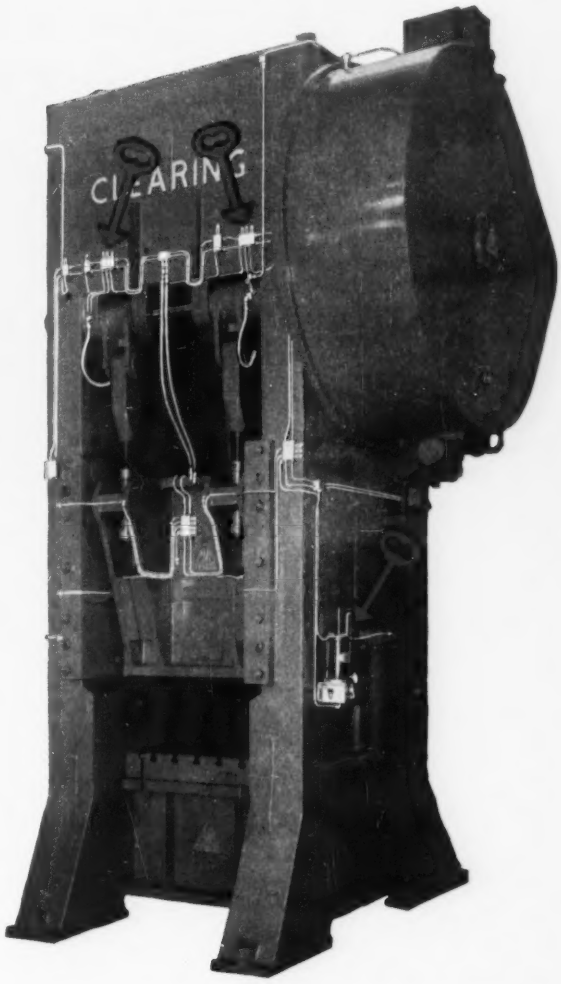
In a lubrication study of this Clearing press, hand-oilers were clocked with a grease gun as they lubricated, cleaned nipples, refilled gun, climbed and traveled from point to point. Averages show that it takes .747 minutes of labor per point to do all this. Thus, to grease this 41-point press by hand once per shift would take a little over 30 minutes. That's one hour a day based on a two-shift day.

Now, look at Farval. Experience shows that it takes only .188 minutes of labor per point to build up and hold pressure and lubricate. On the same basis, Farval lubrication takes a little over 10 minutes per two-shift day. This includes time for filling the Farval reservoir once every 5 days. In other words, Farval saves 50 minutes out of every hour of oiling labor! With larger Farval systems and with more points per press, the time savings are even greater.

Farval is the original Dualine system of centralized lubrication that delivers oil or grease under pressure to a group of bearings from one central station, in exact quantities, as often as desired. The Farval valve has only two moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Indicators at every bearing show that each valve has functioned.

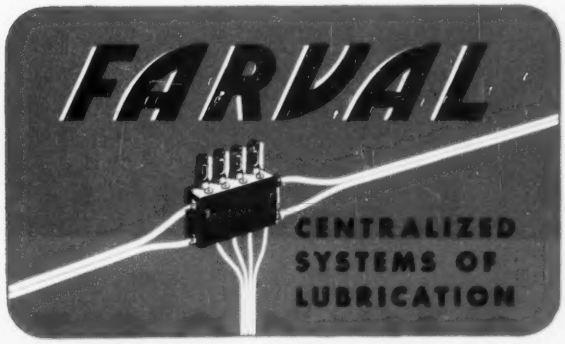
Get full information on the Farval system of centralized lubrication by writing today for new Bulletin 26. The savings possible in your own plant will surprise you! The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

The 310-ton Clearing press shown above is installed in a well-known automobile plant in Michigan. You can see the major part of the Farval manual system—valve manifolds, lubricant lines and manual pumping unit. Within seconds and without moving from the central pumping station, one man can lubricate all 41 points.



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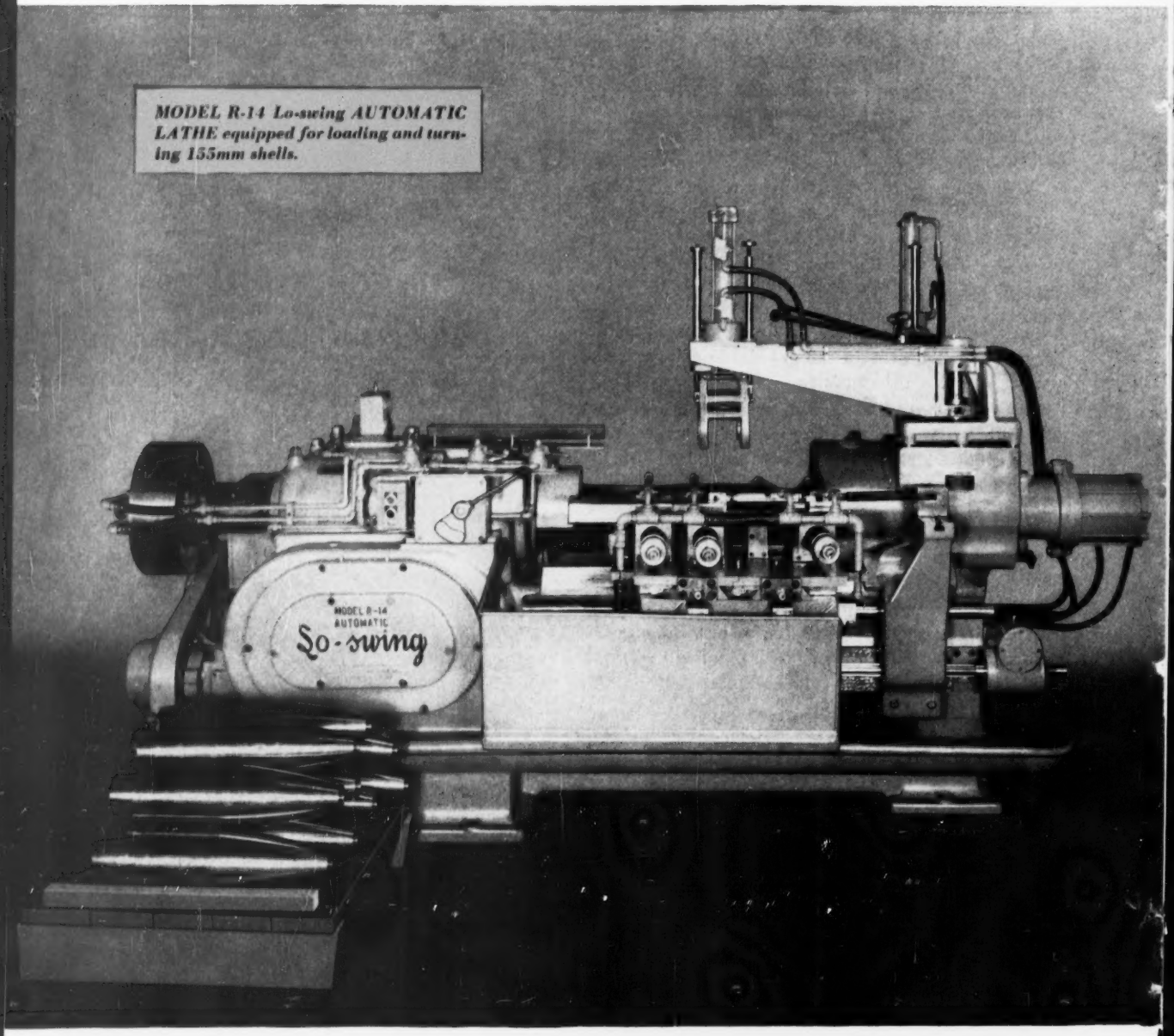
MACHINE OF

MODEL R-14 *Lo-swing* LATHE FINISH TURNS 155mm SHELLS AT HIGH PRODUCTION RATE

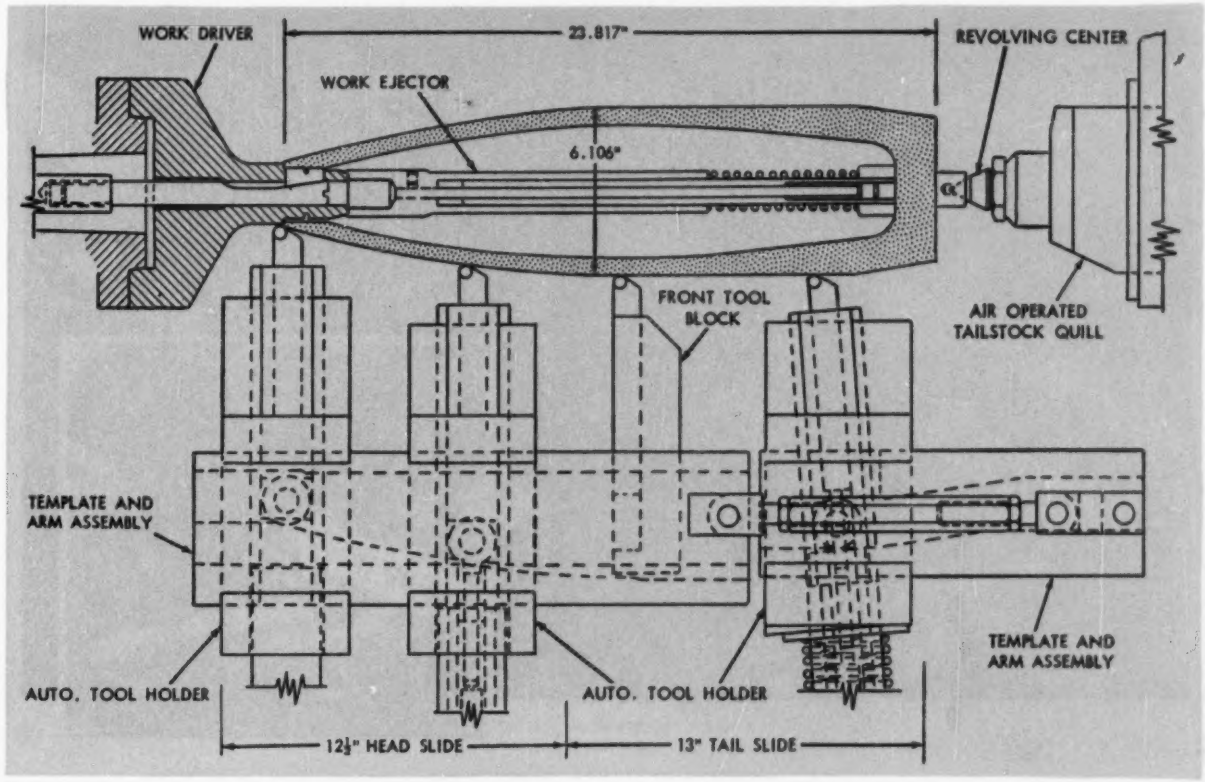


MODEL R-14 Lo-swing AUTOMATIC LATHE equipped for loading and turning 155mm shells.

PRODUCTION COSTS

THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK



PROBLEM: To finish turn the contour of 155mm shells and provide other than manual means for loading and unloading work.

SOLUTION: The Model R-14 Lo-swing Automatic Lathe was selected for this job as it provides the necessary rigidity and power to handle multiple cuts at high cutting speeds with carbide tools.

The illustration opposite shows the fully-equipped lathe and several finished work pieces. The line drawing above shows the heavy duty contour turning attachments and the two-step template used for duplicating the profile of the shells. The shell is driven with a special air-operated, three-jaw driver and location is taken from the finished face of the nose of the shell.

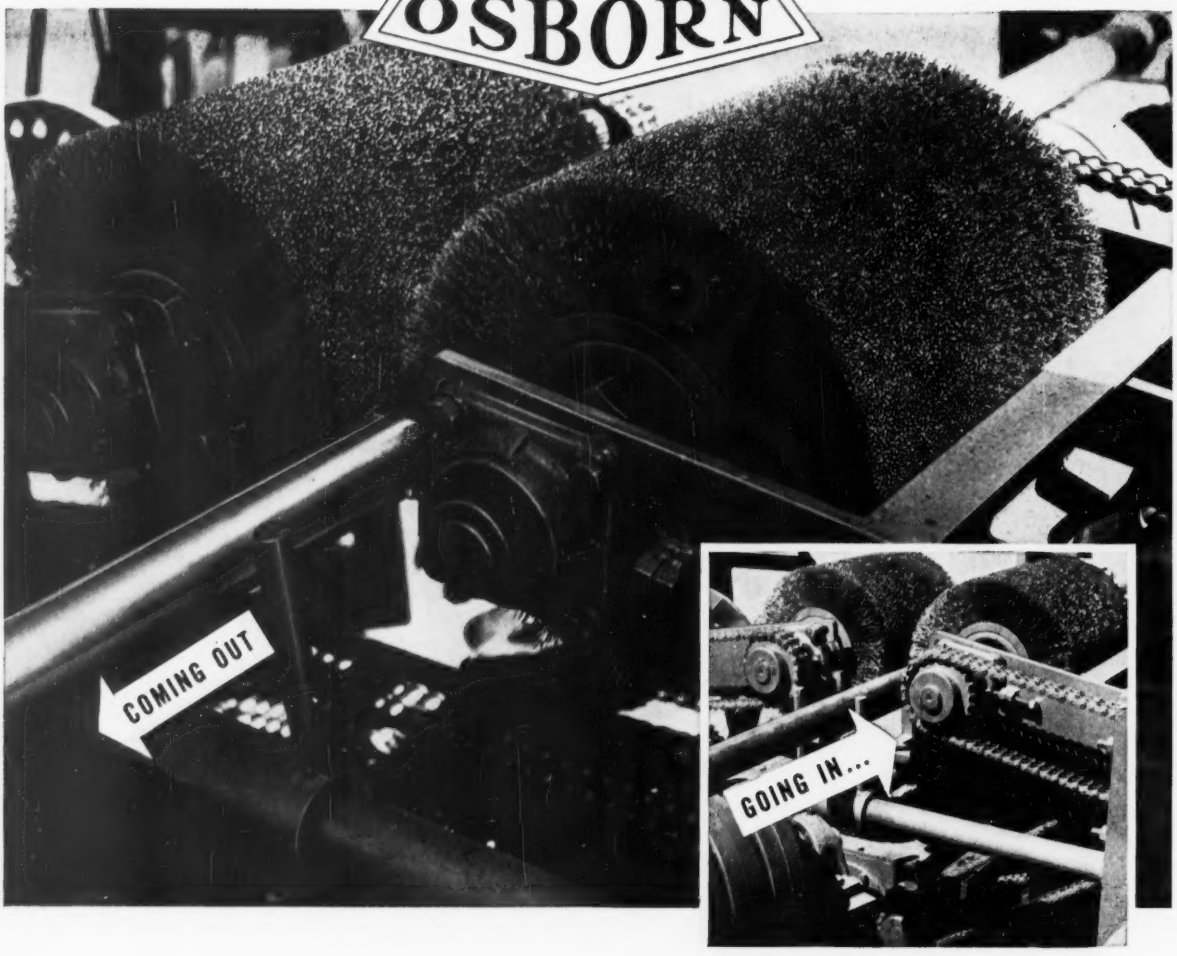
The problem of loading and unloading the shells, which are too heavy for an operator to handle, was solved with the double-arm, pneumatically-operated loader shown in the illustration. Rough shells are delivered at the rear of the machine on a conveyor. In position No. 1, one arm of the loader is directly above this conveyor and, when lowered, picks up a rough shell, while the other arm picks up a finished shell from between centers. The operator then throws the air control valve, which raises the loading device and swings it through 90° to No. 2 position, delivering the rough shell between centers and the finished shell to a second conveyor, located at the front of the machine, which leads to the next operation.

The shells are automatically released from the driver nose by the spring loaded ejector, the details of which are shown in the line drawing. In operation, the loader fingers are first clamped around the finished shell and, as the tailstock center is retracted, the spring loaded ejector forces the shell clear of the driver nose.

Seneca Falls engineers are at your disposal for a solution of all turning problems.

ARE LOWER WITH *Lo-swing*

OSBORN



Turns out a manhour saving of 90%

This brushing machine cleans pipe with one-tenth the manhours required for hand tool brushing . . . and does a thorough job. The pipe passes between these Osborn Master® Wheel Brushes, whirling at 1800 RPM. Loose mill-scale and corrosion disappear, leaving a perfectly clean surface for painting.

This "push button" brushing operation is typical of thousands devised with the help of the **O**sborn **B**rushing **A**nalyst. Very likely, he can help you . . . whether you process pipe or any of a multitude of other metallic or non-metallic products. Call your nearby OBA today to help cut your cleaning, finishing and deburring costs —or write *The Osborn Manufacturing Company, Dept. D-15, 5401 Hamilton Ave., Cleveland 14, O.*

FREE: New booklet on deburring with Osborn Power Brushing. Write for your copy.

Osborn Brushes

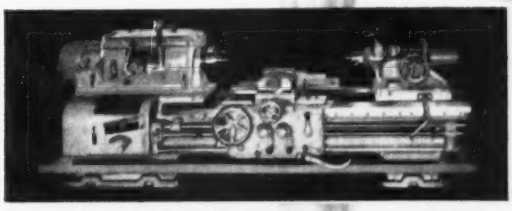
OSBORN BRUSHING METHODS • POWER, MAINTENANCE AND PAINT BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

For more information on products advertised, use Inquiry Card, page 247

A LATHE IS BORN...

AXELSON'S OWN FOUNDRY ASSURES A PRECISE AND RUGGED OFFSPRING

An Axelson lathe starts its long life under the watchful eyes of Axelson's own foundry experts. This means specifically, quality control begins at the beginning — in the lathe bed itself. Axelson's 40 years of lathe production is backed by even longer experience in foundry practice (1892). Every bed is *underground cast*, way side down, to insure closest possible grain structure and to achieve natural annealing and aging. Important, too, is the fact that all other cast parts, such as the carriage, the headstock case and cover, the tailstock body and block, receive the same rigid quality control. By operating our own foundry, much higher than normal specifications can be indicated—***and met.*** Thus, when we say at Axelson "A Lathe is Born," it is meant literally. At Axelson it is the offspring of experts — from the ground up.



HERE IS A PARTIAL LIST OF AXELSON LATHE USERS: ALUMINUM COMPANY OF AMERICA • BOEING AIRCRAFT COMPANY • CALIFORNIA INSTITUTE OF TECHNOLOGY • CESSNA AIRCRAFT COMPANY • CHRYSLER CORPORATION • DEERE WATERLOO TRACTOR WORKS • DOUGLAS AIRCRAFT COMPANY • DOW CHEMICAL COMPANY • E. I. DU PONT DE NEMOURS & COMPANY, INC. • FORD MOTOR COMPANY • GENERAL ELECTRIC COMPANY • HUGHES TOOL COMPANY • SOUTHERN PACIFIC RAILROAD • UNITED STATES NAVY

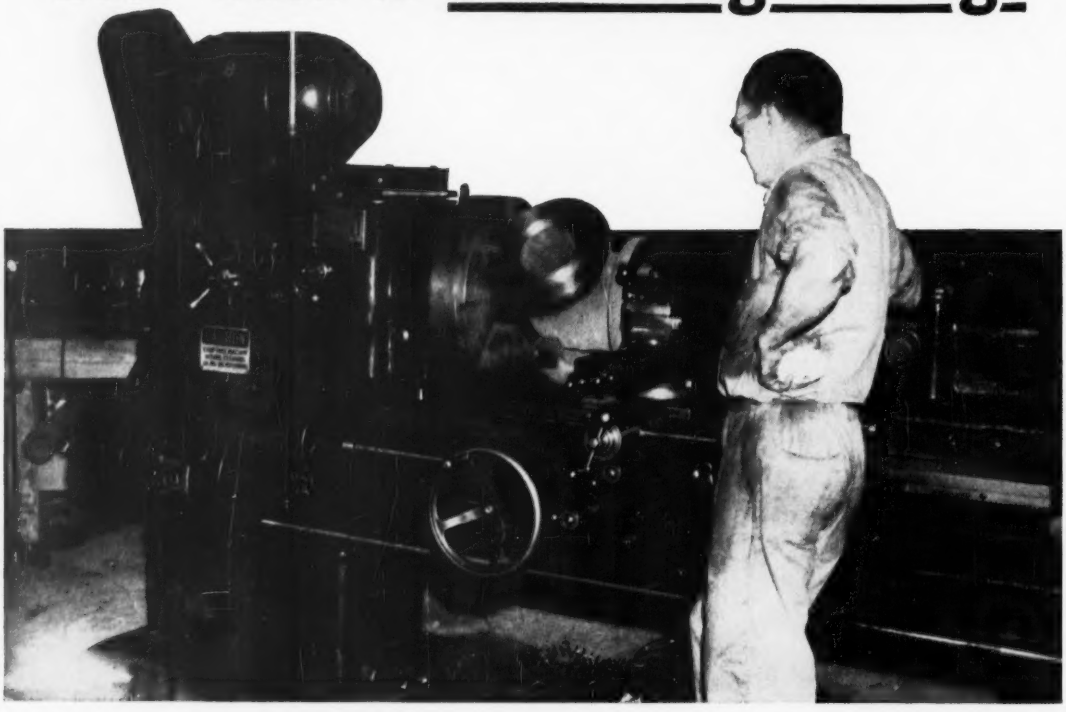
AXELSON MANUFACTURES LATHES IN THE FOLLOWING MODELS AND SIZES: ENGINE LATHES, 16" H. D., 2" H. D., 21" H. D., 25" H. D., 32" H. D.; PRECISION TOOL ROOM LATHES, 16", 21", GAP BED LATHES, 16"/14", 16"/25". HOLLOW SPINDLE LATHES, 21" WITH 8-1/4" HOLE, 25" AND 32" WITH 11" HOLE. 12" HOLLOW SPINDLE LATHE ALSO AVAILABLE IN GAP MODEL. ALL LATHES ARE FURNISHED IN VARIOUS LENGTHS AND WITH A WIDE RANGE OF TIME SAVING ACCESSORIES.

AXELSON MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, ST. LOUIS 10, NEW YORK 7, TULSA 1

PSC — BOX CARS • HOPPER CARS • GONDOLA CARS • REFRIGERATOR CARS • STANDARD PARTS • DAIRY CANS & EQUIPMENT • SELF-CLOSING WASTE RECEPTACLES • PERMANENT STAINLESS STEEL COOKWARE • AUTOMOBILE ACCESSORIES • FARM MOLDING TANKS • STORAGE HOPPERS • ALLOY STEEL CONTAINERS • OIL STORAGE TANKS • RENDERING & SOFTENING TANKS • RESIDENTIAL FUEL OIL TANKS • AGITATORS • SMOKE STACKS • DUST COLLECTORS • COAL & ASH HOPPERS • LOCK NUTS & BUSHINGS • COUPLINGS & CONNECTORS • FITTINGS & ELECTRICAL ACCESSORIES • ORDNANCE MATERIEL • UNISHELTER RELOCATABLE HOMES • EXPORT ONLY: LOCOMOTIVES & TRACKWORK • MINE & ORE CARS • UNISTRUT METAL FRAMING • CANE CARS • INSPECTION CARS • WEED BURNERS • BRICK & TILE MACHINERY • CANE LOADERS

LATHES: ENGINE • TOOL ROOM • HOLLOW SPINDLE • GAP BED • PETROLEUM PUMPING EQUIPMENT: DEEP WELL PLUNGER PUMPS • SUCKER RODS • HYDRAULIC LONG STROKE PUMPING UNITS • AIRCRAFT COMPONENTS

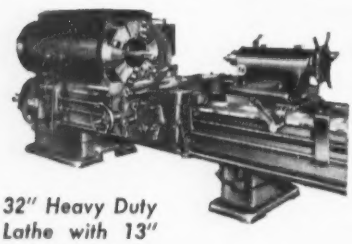
The First Lehmann HYDRATROL Lathe Ever Sold is Still Going Strong!



18 Years of Grueling Service for Lathe #5155

Here is dramatic proof of the durability and rugged dependability of Lehmann HYDRATROL Lathes! The first Lehmann HYDRATROL, sold over 18 years ago, is still operating every day. The present owner of this Lathe, A. J. Flowers of the W. L. Flowers Machine and Welding Co., Alice, Texas, recently wrote us:

"We are happy to say we are still operating the Lehmann Lathe Serial No. 5155. We have averaged operating the lathe sixteen hours each day. It is giving excellent service."



32" Heavy Duty Lathe with 13" Hole in Spindle

FIVE SIZES—18" to 36"

Small . . . . 18" up to 7⅛" Hole
Medium . . . 25" up to 12" Hole
Large . . . . 32" up to 13" Hole
Large . . . . 36" up to 16½" Hole
(Standard type lathes, 16" to 36")

Remember these important HYDRATROL features:

• 16 spindle speed changes with only a "Twist of the Wrist" • Automatic slide rule co-ordinated with movement of handle shows spindle revolutions per minute and indicates cutting speeds in feet per minute • 16 forward and 8 reverse speeds • No need for intermediate stop; unnecessary to disengage the friction driving clutch to change speed • Hydraulic friction clutches and hydraulic brakes, self compensating • Automatic safety relay for harmless and easy engagement of positive clutches when speeds are changed • Spindle release for chucking • Safety-control lubrication with filtered oil • Gears constantly in mesh • Safe in operation • Simple construction and operation.

For Catalog, additional information or recommendation write:

LEHMANN MACHINE COMPANY
GRAND at CHOUTEAU • ST. LOUIS 3, MO.

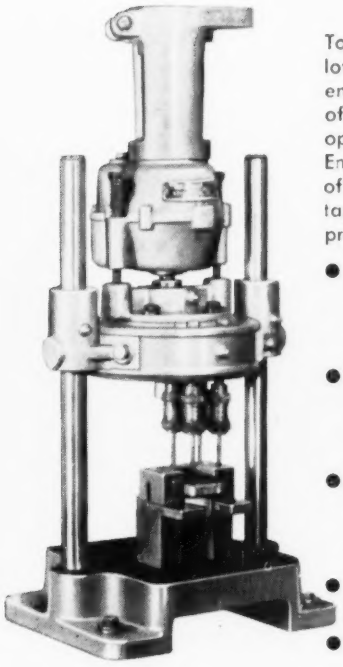
DIVISION OF NOVO ENGINE CO.

For more information on products advertised, use Inquiry Card, page 247

If you tap or drill small parts

you can't afford to be without— Ettco-Emrick

"UNIT-ENGINEERED" MULTIPLE HEADS



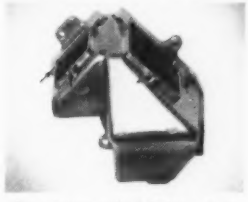
To put your small parts tapping and drilling on a low-cost, mass production basis you need specially engineered methods and equipment. Ettco's years of specialization in this field has led to the development and refinement of the Ettco-Emrick "Unit-Engineered" Multiple Head System, which is one of today's fastest, most economical methods of tapping and drilling small parts. Here's what it provides —

- *Multiple head and work holder engineered as a unit for your specific part to insure fastest handling and production with each stroke of the drill press.*
- *A selection of dozens of different standardized methods of handling a wide variety of shapes and sizes of parts and number and spacing of holes.*
- *Interchangeable tapping and drilling face plates to permit quick, easy changeovers from tapping to drilling — a patented Ettco-Emrick feature.*
- *A design that assures quick, easy installation on any make or model drill press.*
- *A limitless variety of spindle arrangements with capacities ranging from wire sizes to ⅝" in steel.*

DO JOBS LIKE THESE FASTER, EASIER, AT LESS COST

Steel outlet box with 4 tapped holes. Production—12,800 tapped holes per hour with dual multiple head unit.

54 holes drilled and countersunk in one operation with a multiple head and electric indexing fixture.



Die casting with 6 holes — 3 in each of two planes — automatically positioned and tapped in one operation.

If your small parts production calls for multiple drilling, reaming, countersinking, tapping or threading — it will pay you to check with Ettco. Call in your nearest Ettco-Emrick distributor or send us a sample or drawing for recommendations and estimates.

FOR DETAILS, WRITE FOR BULLETIN No. 3

Ettco-Emrick

ETTCO TOOL CO., INC.

592 Johnson Ave., Brooklyn 37, N. Y.

DETROIT • CHICAGO • WORCESTER • SAN GABRIEL, CALIF.

Dealers throughout the United States and Canada

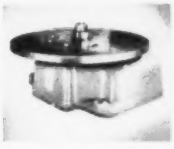
For more information on products advertised, use Inquiry Card, page 247

DRILLING and TAPPING EQUIPMENT NEWS

Tapping Machines Boost Multiple Head Output

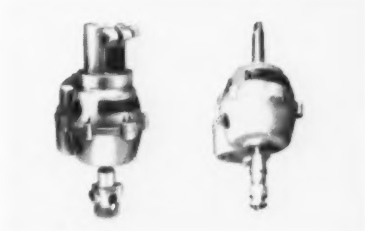
Ettco-Emrick tapping machines are designed for automatic or semi-automatic operation with multiple spindle drilling or tapping heads and single spindle tapping attachments. The No. 72A machine is foot or air-operated. The No. 74 machine is air operated and electrically controlled. *Details in Bulletins No. 72A and No. 74. Write Ettco Tool Co., 592 Johnson Avenue, Brooklyn 37, N. Y.*

Electric Indexing Fixture Has Fast, Precise Action



Ettco-Emrick Indexing Fixtures provide smooth, shockless, positive action. Can be used on any machine base. Synchronization of index fixture with outside machine member is electrically controlled. Utilizes interchangeable nesting plates ranging from 10" to 14" in diameter. *Details in Bulletin No. 97. Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn 37, N. Y.*

Tool Up Any Drill Press For Fast, Accurate Tapping



Ettco-Emrick tapping attachments can be mounted on any drill press. Newly patented friction clutch provides the delicate sensitivity needed for high speed tapping or threading. 7 different models for No. 6 to ⅝" dies and for No. 0 to 1" taps. *Details in Bulletin No. 22. Write Ettco Tool Co., 592 Johnson Ave., Brooklyn 37, N. Y.*

New York City Skyline from New Jersey — Shostal Press Agency Photo

BULLARD

The Invisible Background of Industrial Progress

Modern high-speed roadways with their connecting tunnels and bridges make possible swift and economical surface movement of industry's raw materials and finished products from their source to the ultimate user. Those engaged in agriculture also depend on this means of transportation to move their produce from farm to processor to consumer. Modern American families rely on these modern roads in their pursuits of pleasure, vacation and business.

Likewise, *Modern Machine Tools* provide the manufacturers of road-building equipment, such as mechanical shovels, bulldozers, trucks and road rollers, with efficient means for manufacturing such essential equipment. Here then is "The Invisible Background of Industrial Progress."

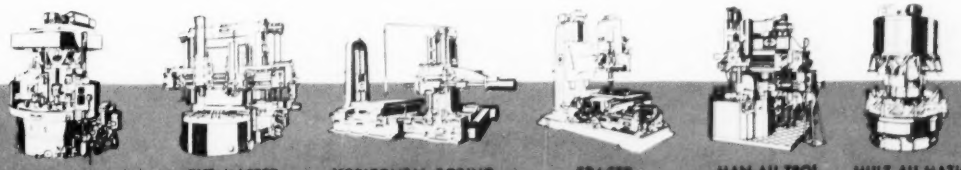
THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT

Available in six sizes
30" through 74"

New products, new methods, new materials, and new cutting tools have out-dated many machine tools still in use. Is your plant operating under this handicap? If so, it will pay you to investigate the Bullard Cut Master Vertical Turret Lathe.

In the Cut Master, you will find a machine that incorporates outstanding engineering developments which make for increased production, ease of handling, accuracy, minimum operator fatigue and decreased maintenance cost. All these add up to greater profits through lower costs — so important in today's competitive market.

For full details on the Bullard Cut Master Vertical Turret Lathe, call your nearest Bullard representative or write to The Bullard Company, 286 Canfield Avenue, Bridgeport 2, Connecticut — phone 6-2511.



BULLARD

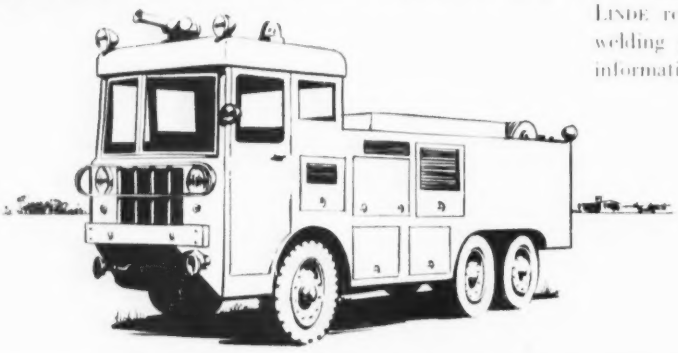
the FIRE TRUCK *that flies*

From rumbling horse drawn wagons, to the massive pump-trucks of today—weight has been the common characteristic of mobile fire-fighting equipment.

However, with the expanding science of fire-fighting, there came new demands of equipment. The United States Air Force had need for fire trucks fully equipped, yet light enough to be carried by air to landing strips the world over. Such trucks are now in production—fabricated by HELIARC and sigma welding.

The fire truck's rigid lightweight all-aluminum body, which varies in thickness from 11 ga. to $\frac{3}{8}$ in., is completely welded by HELIARC and sigma welding at speeds up to 25 in. per minute. Because welding speed is high, and inert gas welding eliminates expensive post-weld cleaning, this manufacturer turns out three units a day—employing only 10 men.

Research and years of experience have helped LINDE to develop a top notch team of fabricating processes—HELIARC, sigma and UNIONMELT welding. For small shops or huge production lines, from carbon steel to complex alloys and non-ferrous metals—there is a LINDE electric welding process to do the job efficiently and economically. Your local LINDE representative will help you determine the best welding process for your job. Call him today for more information.



Linde
TRADE-MARK

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Principal Cities

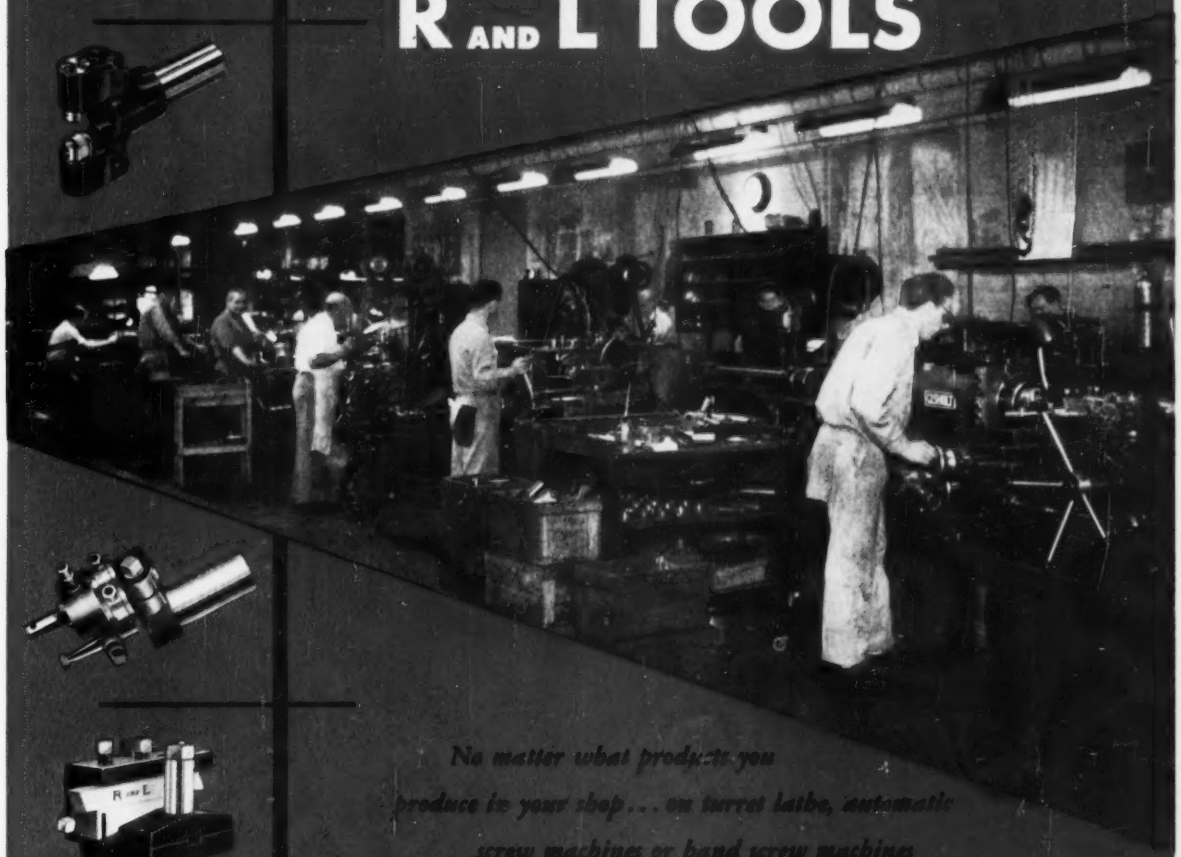
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited

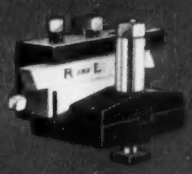
"Heliarc," "Unionmelt," and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation

For more information on products advertised, use Inquiry Card, page 247

NO SHOP CAN AFFORD TO BE WITHOUT...

R AND L TOOLS





No matter what products you produce in your shop... on turret lathe, automatic screw machines or hand screw machines

you cannot afford to be without R AND L Tools

The very first job on which you use these tools will introduce you to the many savings you can accomplish with them. R AND L TOOLS QUICKLY PAY FOR THEMSELVES.

SEE R and L TOOLS AT BOOTH NO. 124 INDUSTRIAL EXPOSITION, PHILADELPHIA APRIL 24-30.

Write for catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

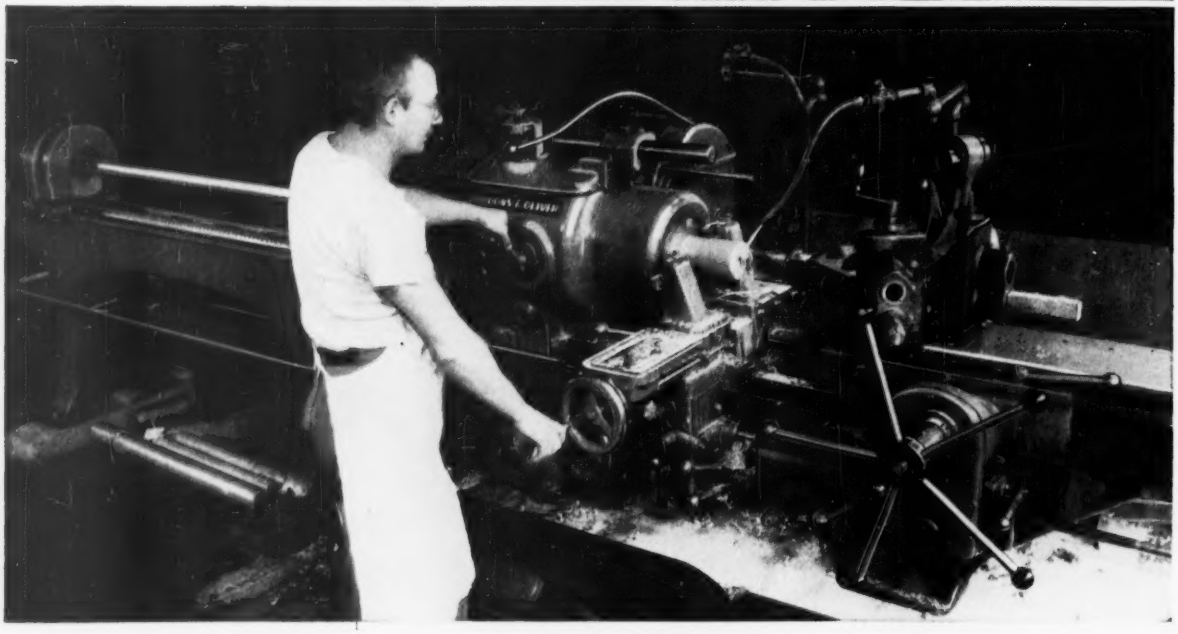
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

BARDONS and OLIVER TURRET LATHE PERFORMANCE

"Beyond our Expectations"

says

Bausch & Lomb Optical Co.



Mr. Albert Witt, Foreman of the Castings & Complicated Parts Department says: "The Bardons & Oliver Turret Lathe is performing beyond our expectations. We are now holding dimensional tolerances to within .002", well within the tolerance for machining parts of this size group. It is felt, however, that the machine is capable of producing parts within a tolerance of .001". With our new Bardons & Oliver Lathe we have found that we can greatly reduce machining cycles. With the extra attachment (Hydraulic Bar Feed) we have found it greatly diminishes the operator's effort, thereby reducing cost. We are using this machine for all of our large parts including the CinemaScope Lens Mount on which precision is required."

Mr. Witt's comments refer to the Bardons & Oliver No. 7—4½-inch collet capacity, Ram Type Turret Lathe.

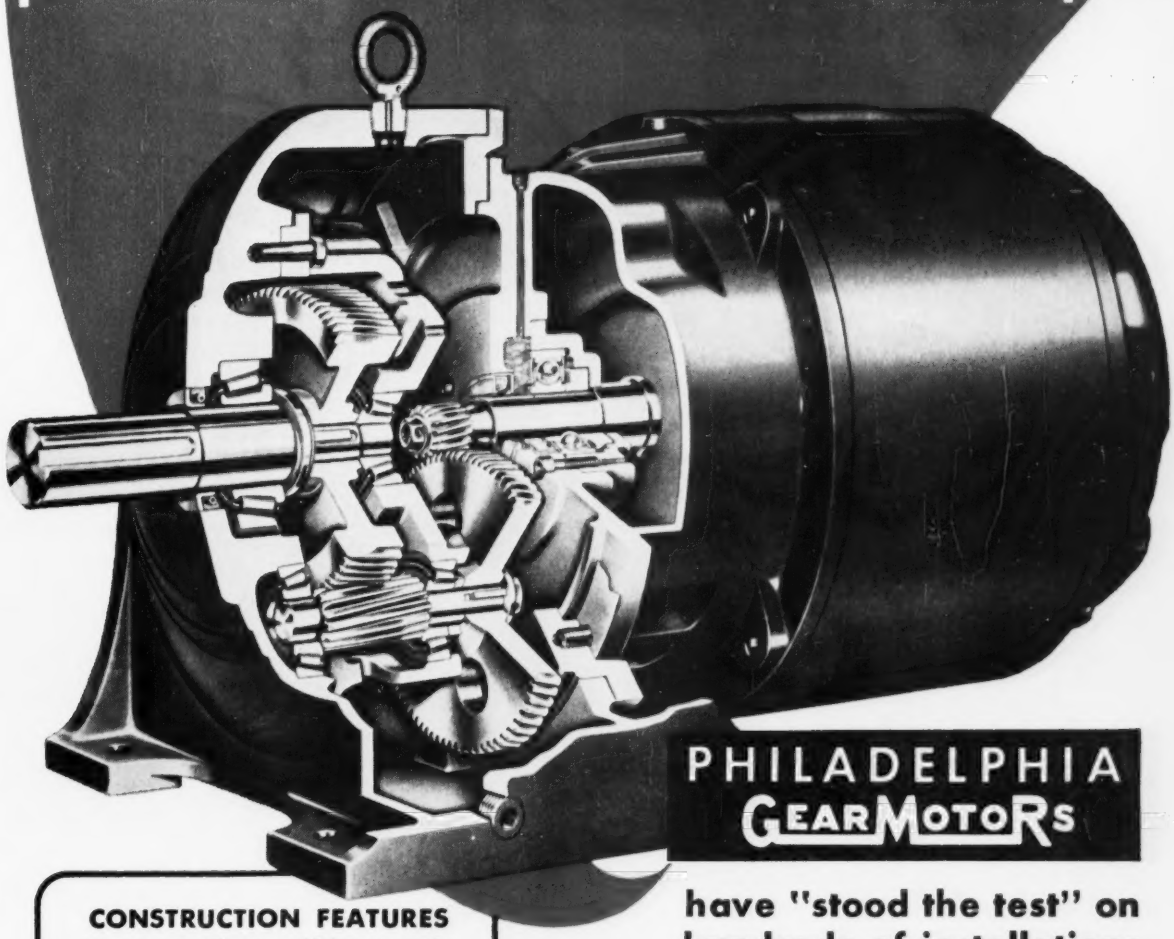
Why not send us blueprints and let us quote on your work. Inquiries will receive prompt attention.

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

For more information on products advertised, use Inquiry Card, page 247

performance IS THE BEST TEST OF leadership



PHILADELPHIA GEARMOTORS

CONSTRUCTION FEATURES

Compact without sacrificing strength or accessibility.

Self-Contained Motor and Gear Unit are combined yet readily separated for inspection . . .

Quiet Simple gear train minimizes number of moving parts and promotes quiet operation.

Standardized Construction Interchangeable parts simplify assembly and maintenance.

Prompt Delivery—Most motors in stock.

have "stood the test" on hundreds of installations

In almost all branches of industry Philadelphia GearMotoRs are giving the trouble-free service that is proof of their excellent design and precision manufacture.

Where the direct application of electric drive to individual machines is desired the Philadelphia GearMotoR will conserve space and simplify the installation as well as offer definite operating advantages.

They are available in single, double and triple reductions with a speed range from 780 through 7.5 R.P.M. Motor ratings run from 1 HP through 75 HP AC or DC.

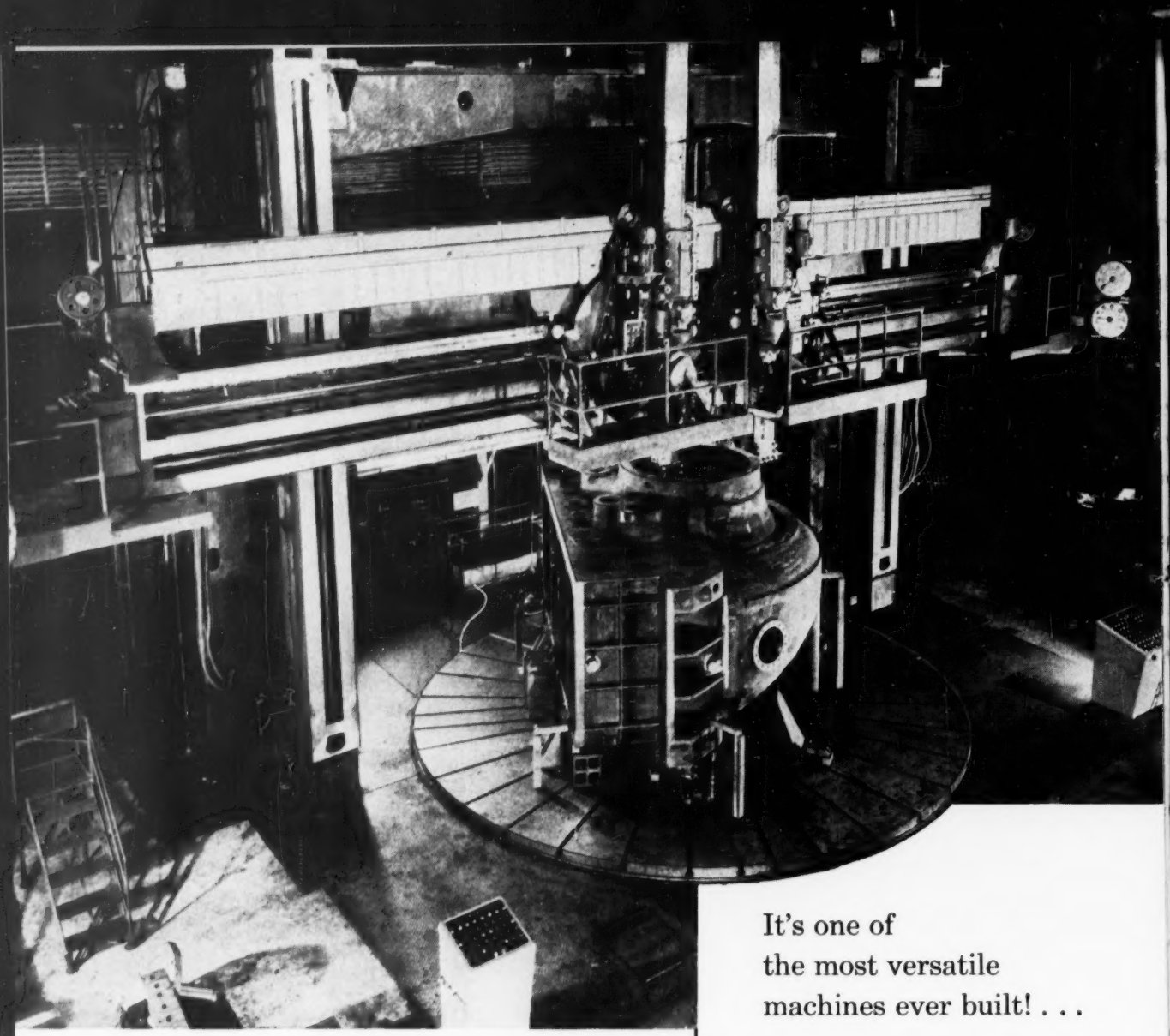
Our Catalog GM-48 gives full details.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



Allis-Chalmers Says:

"OUR NILES 30 FT. BORING MILL WILL BE MODERN FOR MANY YEARS"

"Advanced controls and speed ranges which will remain modern for decades were what we wanted in a 30-foot boring mill," Allis-Chalmers reveals. "This Niles-built mill at work in our Milwaukee plant has fully met its high expectations.

"It is felt that its ruggedness and reliability will equal that of the 40-foot mill built by Niles in 1928 and in continuous operation at Allis-Chalmers for 25 years."

New Catalog! Write for details on the Niles standard line of vertical boring mills to 43 feet, side-head mills to 54 inches, 6-inch horizontal mills, heavy duty engine lathes to 120 inches.

It's one of the most versatile machines ever built! . . .

- ★ Electrical control of all movements except where hand setting is desired
- ★ 45-degree motor-operated swivel of boring bars
- ★ Four station electrical control
- ★ Detachable milling head
- ★ Automatic warning of incorrect lubrication
- ★ Maximum swing—30 feet, 5 inches
- ★ Maximum height under tool—17 feet
- ★ Bar travel—10 feet

BALDWIN · BLH · LIMA-HAMILTON

BALDWIN—LIMA—HAMILTON

Hamilton Division, Hamilton, Ohio

ANACONDA METALS AT WORK

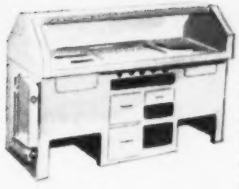
Meet the educated screw

This is a whole family of screws, known as Screwsticks, and joined head-to-toe. Insert a Screwstick in the driver, aim it at the hole—and from there on the Screwstick tightens itself to the predetermined torque, shears itself and gets its head burnished by the following screw which automatically advances itself. It's so fast that American Screw Co. of Willimantic, Conn., which uses ANACONDA Hexagon Brass Rod, refers to it as "jet propulsion".

Don't lose your grip

Once a novelty trick developed by the Chinese, the manufacture of these grips is now an industry. Made in a wide variety of styles and sizes by Economy Cable Grip Co. of Norwalk, Conn., they are used to anchor suspended electric power cables and to seize the end for pulling through ducts. The harder you pull, the tighter they grip. Needless to say, the ANACONDA Bronze Cable, Everdur* Rod and Copper Tube used in their manufacture never weaken from rust.

A fast delivery...with mustard



When baseball fans want their hot dogs, they want them fast—so Stainless Alloy Fabricators of Detroit built this "Double-Header" baseball park hot dog server. Its big capacity for hot dogs—and fast service—is its double bun warmer, one at each end, heated by copper water boilers. If the water runs dry, it's no strike-out. Boilers are made of phosphorized copper sheet with joints formed by fusing the edges with a Heliarc torch. No solder used, no seams to burn open.

How to treat a fracture

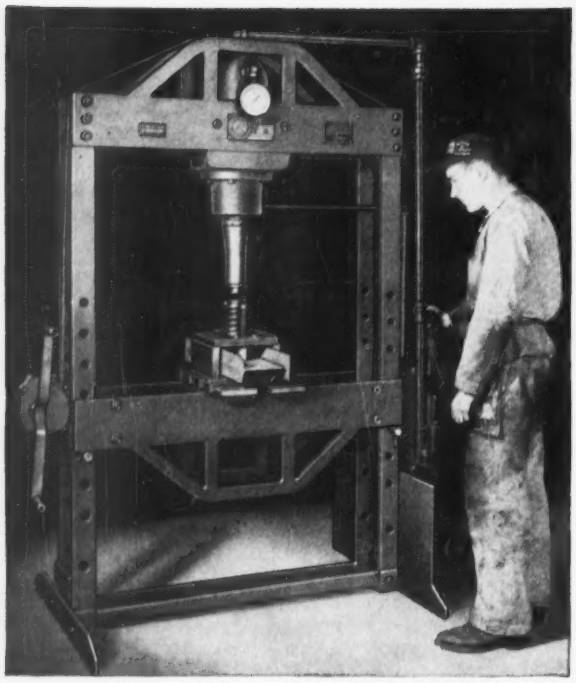
A fracture often means long uselessness—but that needn't be true of machinery. Usually braze welding can make it good as new and at a fraction of the time and cost of replacing it. This fractured cast iron conveyor drive sprocket, for example, would have taken two months to replace. The Universal Welding Co., Rochester, N. Y., repaired it in only 7 hours by braze-welding with ANACONDA-997 (Low Fuming) Bronze Welding Rod. Moral: don't count the patient out before consulting your welder.

There's more to this than meets the eye

In our Technical Department you will find a range of experience that covers the entire field of copper and copper-alloy applications in the metalworking industries. If you have a problem of metal selection, we are at your service. *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

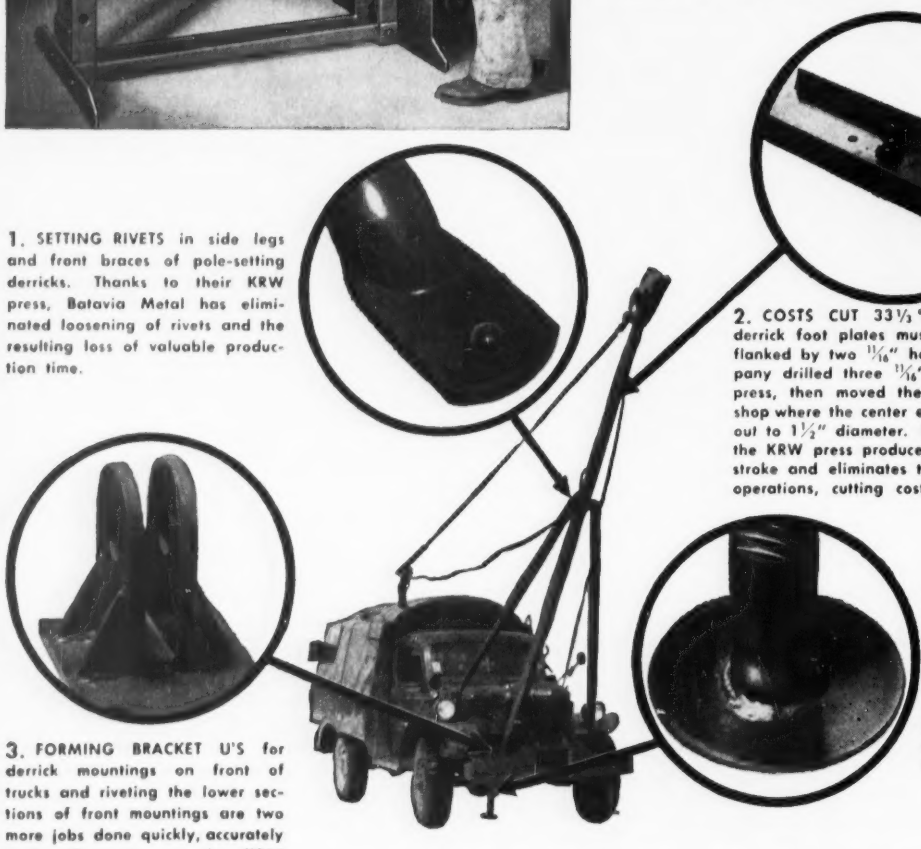
*Reg. U. S. Pat. Off. 5491

ANACONDA® the name to remember in COPPER-BRASS-BRONZE



KRW HYDRAULIC PRESS DOES 4 VITAL JOBS ON POLE-SETTING DERRICKS

BATAVIA METAL CORP. bought a K. R. Wilson 75 ton motor-driven Hydraulic Press two years ago to perform a few routine operations on their pole-setting derricks (derrick shown on telephone truck below). But they soon found that the amazing versatility of the press—the ease and speed with which it can be converted from one set-up to another, makes it a natural for all kinds of trouble shooting. Below are just a few of the jobs their KRW press does.



1. SETTING RIVETS in side legs and front braces of pole-setting derricks. Thanks to their KRW press, Batavia Metal has eliminated loosening of rivets and the resulting loss of valuable production time.

2. COSTS CUT 33⅓% The center hole on derrick foot plates must be 1½" in diameter, flanked by two 11/16" holes. Originally the company drilled three 11/16" holes on a small drill press, then moved the plates to the machine shop where the center eye-bolt hole was reamed out to 1½" diameter. Use of a simple die plus the KRW press produces all three holes in one stroke and eliminates the drilling and reaming operations, cutting costs by more than ⅓.

3. FORMING BRACKET U'S for derrick mountings on front of trucks and riveting the lower sections of front mountings are two more jobs done quickly, accurately and efficiently on the KRW Hydraulic Press

4. FORMING BASES for rachet jacks and restoring proper contour to various castings which sometimes warp as they cool are also regular assignments for this KRW press. Company officials tell us that their KRW Hydraulic press is in use the greater part of every working day

Any pressing problems in your plant? Check with K. R. Wilson for the right press to do the job. KRW Hydraulic Presses come in one, two and three cylinder models; 25 to 150 ton capacities; hand operated, air operated or motor driven. For facts and prices contact your machinery dealer or write, wire or phone us.

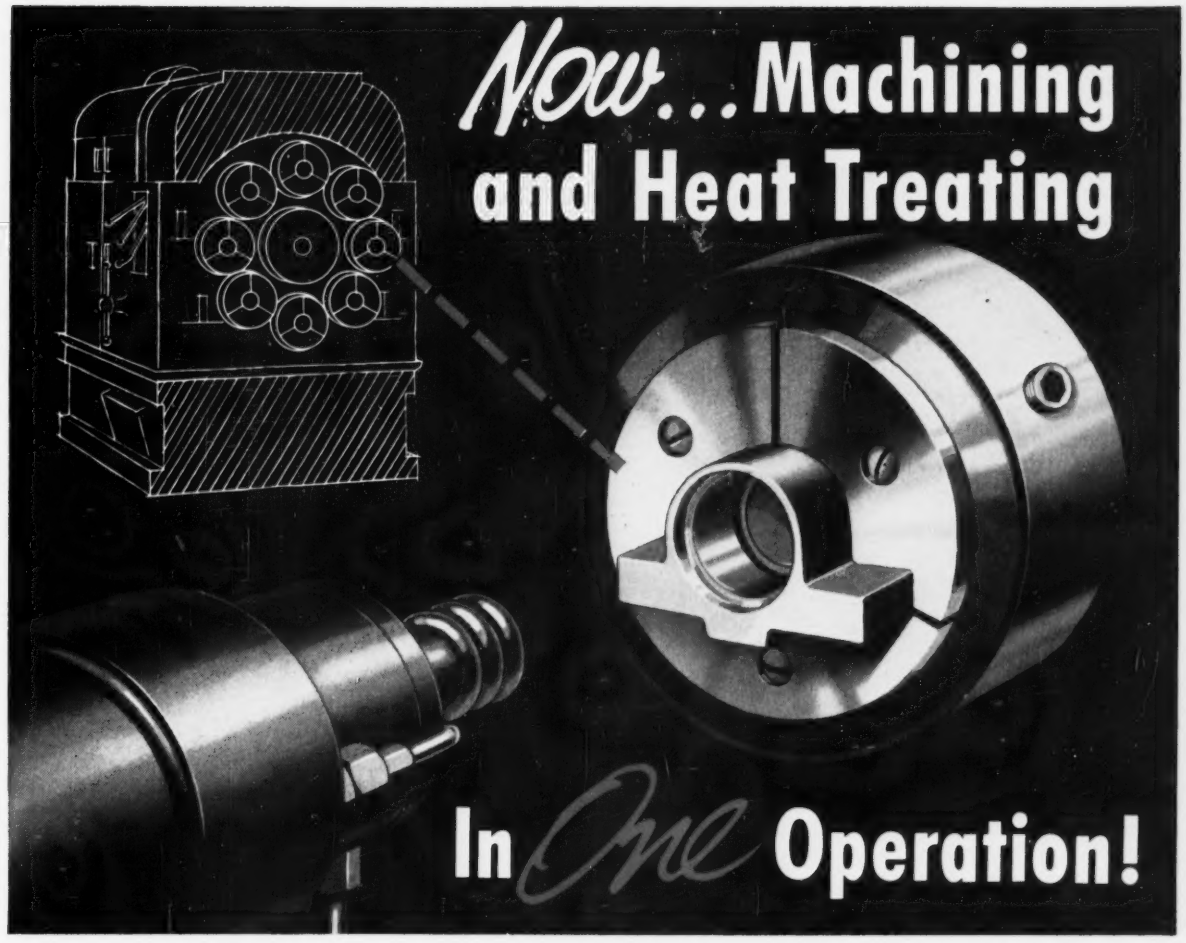
IMMEDIATE DELIVERY on type of press shown above up to 75 ton capacity, hand, air or motor driven.

K. R. WILSON

213 MAIN STREET BUFFALO 3, N. Y.

DESIGNERS AND BUILDERS OF HYDRAULIC PRESSES TO SOLVE ANY METALWORKING PROBLEMS

For more information on products advertised, use Inquiry Card, page 247



with TOCCO Induction Heating

Mechanics Universal Joint Division of Borg-Warner Corporation now combines automatic heat-treating and metal-working operations on the same machine!*

A Tocco Inductor Coil, matched to one spindle of a multiple spindle automatic screw machine, heat treats the inside diameter of automotive trunnion cups—after they have been completely formed on the same machine tool. Twenty-two, 20 and 50 kw, 450,000 cycle TOCCOtron Induction Heating units and 44 automatic screw machines (installed here and in other plants) make up this high-speed production team.

This new method permits the use of SAE 1144 steel and eliminates costly, time-consuming copper plating and carburizing operations formerly required. Heating and quenching cycles total approximately 10 seconds per part, and production is in excess of 300 parts per hour from each machine.

If your products or their components require heat treating, soldering, brazing or forging it will pay you to investigate TOCCO for better, faster ways of producing them at lower unit cost.

*This process developed and patented by TOCCO.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-3, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

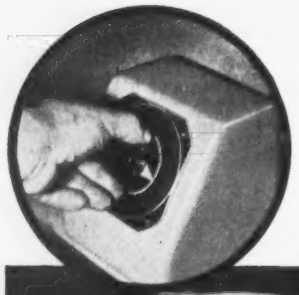
Name_____

Position_____

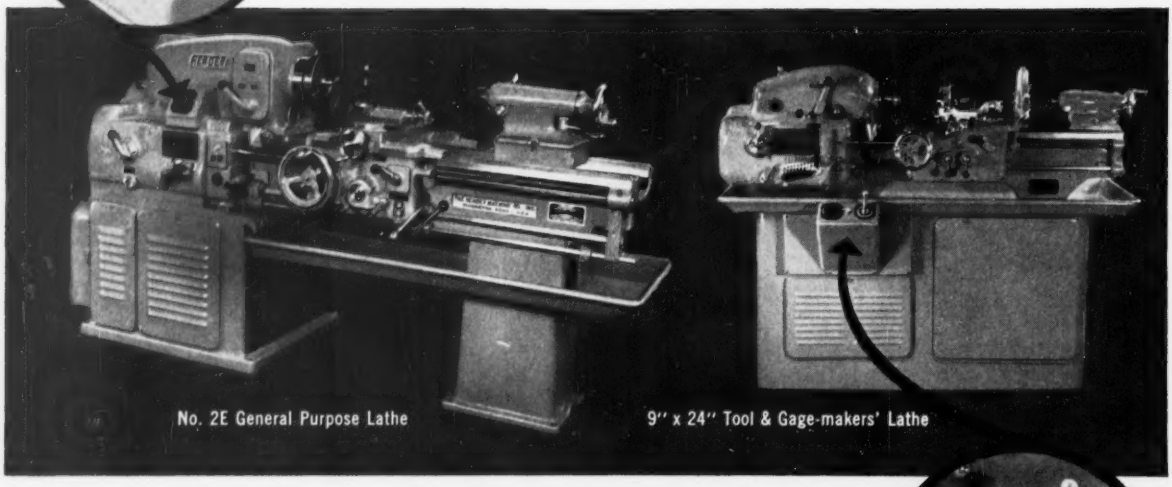
Company_____

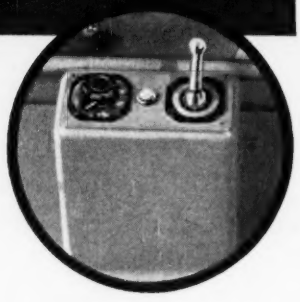
Address_____

City_____ Zone____ State_____



simplifies machine operation ...saves production time





Finger Tip Control of infinite spindle speeds

This outstanding control is featured on two lathes—the new Hendey No. 2E 14" general purpose precision lathe and the Hendey 9" x 24" tool and gage-makers' lathe. It gives infinitely variable spindle speed control through the full range . . . permits adjustments under cut or pre-setting to the most efficient speed.

The Hendey-proved electronic control of the drive motor reduces operator effort to simple speed selection . . . responds immediately to his every spindle speed requirement. Instantaneous electric dynamic braking, plus start, stop, and reverse, are one-lever controlled at the headstock and apron. Hendey finger tip control can save up to 25% production time . . . really cutting turning costs.

Spindle speeds range from 25—3000 R.P.M. on the Hendey 9" x 24", and from 15—1500 R.P.M. on the Hendey No. 2E. Both lathes also feature induction hardened and precision ground bedways . . . precision lead screws . . . convenient grouping of operating controls . . . plus traditional Hendey built-in quality and precision.

infinite speed control

●

speed selection pre-set or while cutting

●

induction hardened and ground bedways

●

precision built

Write for detailed specifications

Hendey machine co., inc.
torrington, conn., u.s.a.
—precision machine tools—

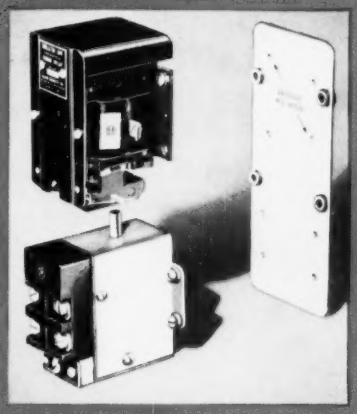
HENDEY

distributors in principal cities

For more information on products advertised, use Inquiry Card, page 247

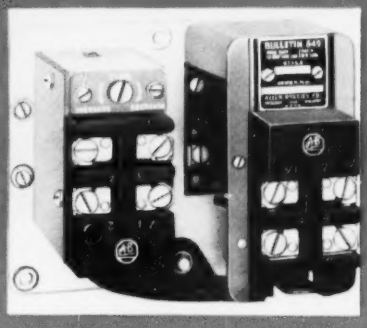
BULLETIN 849 TIMING RELAY CONSISTS OF TWO UNITS

The solenoid operating unit and the pneumatic timing unit are mounted on a steel backplate.



ON-DELAY OR OFF-DELAY

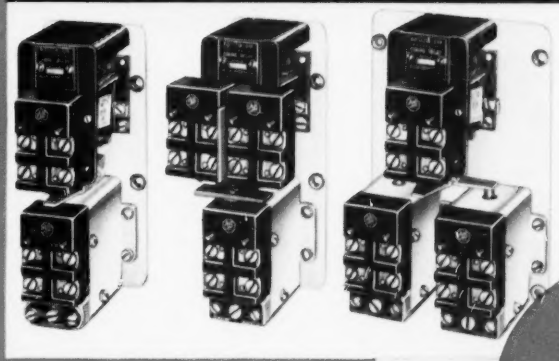
The timer may be arranged for ON-Delay or OFF-Delay. ON-Delay provides time delay when solenoid is energized; OFF-Delay provides time delay when solenoid is de-energized.



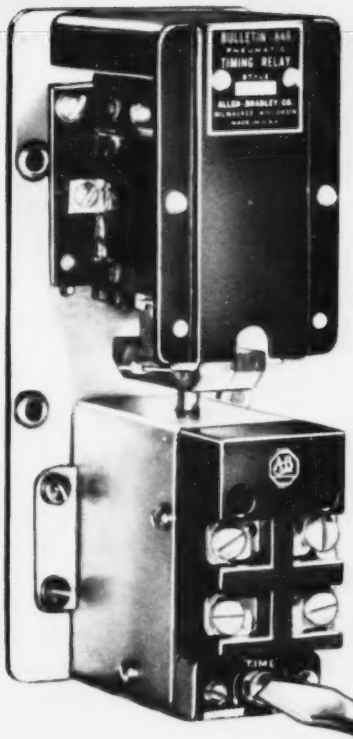
HORIZONTAL CONSTRUCTION

Style ZAX Pneumatic Timer is available for applications in which the horizontal arrangement of solenoid and timing unit satisfies space requirements better than the vertical type.

AVAILABLE IN MANY CONTACT COMBINATIONS



A great variety of contact arrangements can be provided for Bulletin 849 Timers, as shown in the illustrations above. Full details concerning contact arrangements furnished on request.



BULLETIN 849 PNEUMATIC TIMING RELAY

Solenoid Operated

EASY TO ADJUST

for Timing Intervals from 10 Cycles to 3 Minutes

Here is a compact . . . easy to adjust . . . solenoid type pneumatic timer with quick make-and-break silver alloy contacts that operates with an accuracy of ±10% . . . irrespective of temperature, humidity, or vibration. Its wide timing range . . . from 10 cycles to 3 minutes . . . makes it the ideal timer for hundreds of industrial applications.

There are one set of normally open and one set of normally closed contacts. Additional contacts may be mounted on the timer frame and actuated by the same solenoid mechanism. Wiring terminals are all accessible from the front. Send for illustrated Bulletin 849, today.

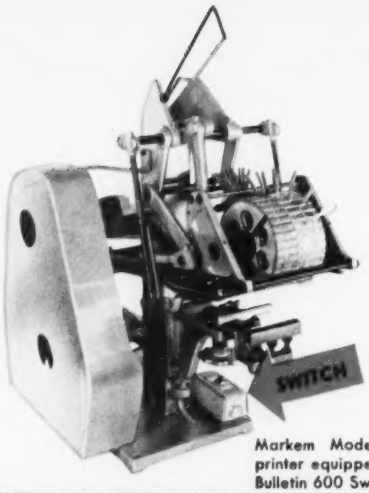
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

A-B Quality

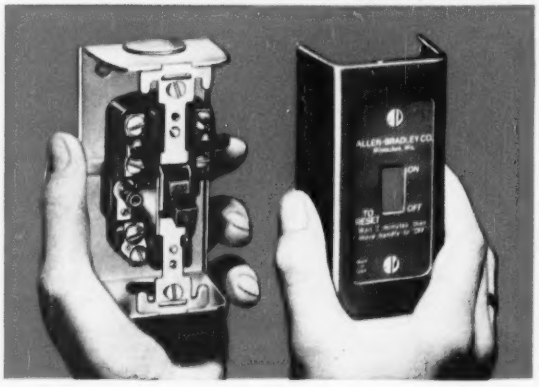
ALLEN-BRADLEY QUALITY TIMING RELAYS

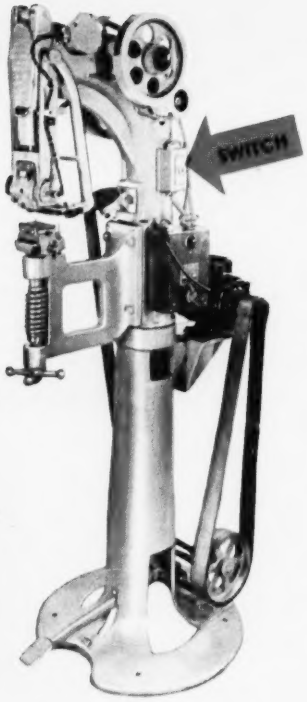
2-54-R

Markem Model 105 heavy duty box and label printer equipped with an A-B Bulletin 600 Manual Starting Switch.



Markem Model 45AC printer equipped with a Bulletin 600 Switch.





Markem No. 2 embosser for indenting and coloring on plastics, wood, leather, etc., with A-B Bulletin 600 Switch.

SNAP SWITCH *with* OVERLOAD BREAKER FOR 1 HP MOTORS AND SMALLER

● Burnouts of small motors can often cause serious production delays. Therefore, dependable overload protection is absolutely essential . . . and for motors of 1 hp or less the Allen-Bradley Bulletin 600 Starting Switch is the logical answer.

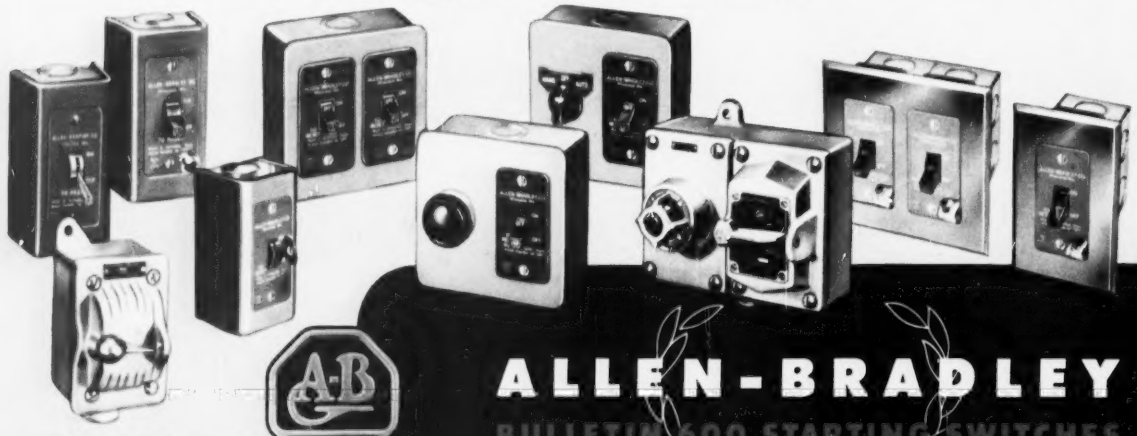
It has a built-in thermal overload breaker which trips the toggle switch in case the motor is overloaded . . . and you can't keep the switch closed until the overload on the motor is cleared.

The Bulletin 600 Manual Starting Switch is ideal for small a-c and d-c motors on space heaters, stokers, refrigeration compressors, fans, pumps, packaging machines, labelers, grinders, and other light machinery.

Available in open type construction and also in standard sheet metal enclosures, waterproof and weatherproof enclosures, and gastight enclosures for installations in hazardous gas locations.

Bulletin 600 Manual Starting Switches can be furnished in various auxiliary combinations—namely, with pilot lights, selector switches, and key and lever switches, as illustrated below. They will fit into standard conduit switch boxes if desired. The double break, silver alloy contacts need no attention. Bulletin 600 gives dimensions and other data.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.



A few examples of the variety of enclosure combinations in the Bulletin 600 Manual Starting Switch line.

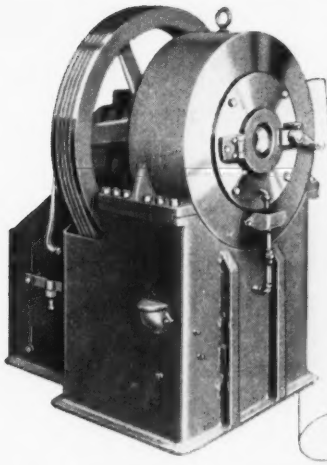
A-B Quality

ALLEN-BRADLEY

BULLETIN 600 STARTING SWITCHES

QUALITY

2-54-MR



Swaging Success Stories

Mandrel Swaging...for time and cost savings

Look at the savings!

1. Saving in time—swaging is fast, increases output.

2. Saving in labor—swaging can be done by unskilled labor.

3. Saving on machining—swaging reduces metal, does not cut it away wastefully.

4. Saving on rejects—the one piece tube is a generally better product than the assembly—has a better finish, better resiliency.

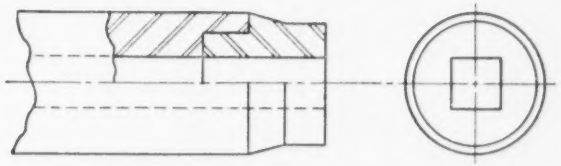
An informative booklet on swaging containing complete descriptions of Torrington Rotary Swagers is yours for the asking. Send for it today; it may save you money tomorrow.

See Torrington Swaging Machines in action.

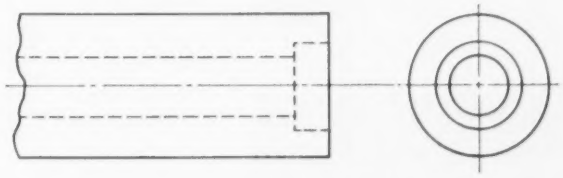
VISIT BOOTH 964

at the ASTE Industrial Exposition, Philadelphia, April 26-30.

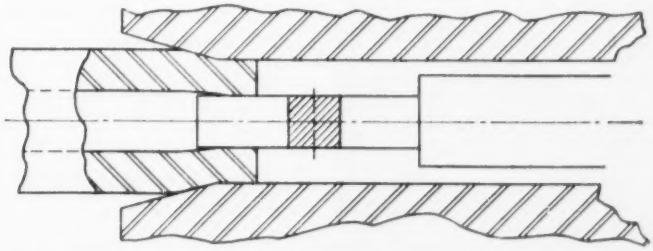
THE TORRINGTON COMPANY
Swager Department
300 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings



This connector tube has a 3/8″ bore, and one end is fitted with a turned nose piece which has a 5/16″ square broached hole to receive a square driving rod. The cost of the tube was greatly influenced by the cost of making and assembling the nose piece.



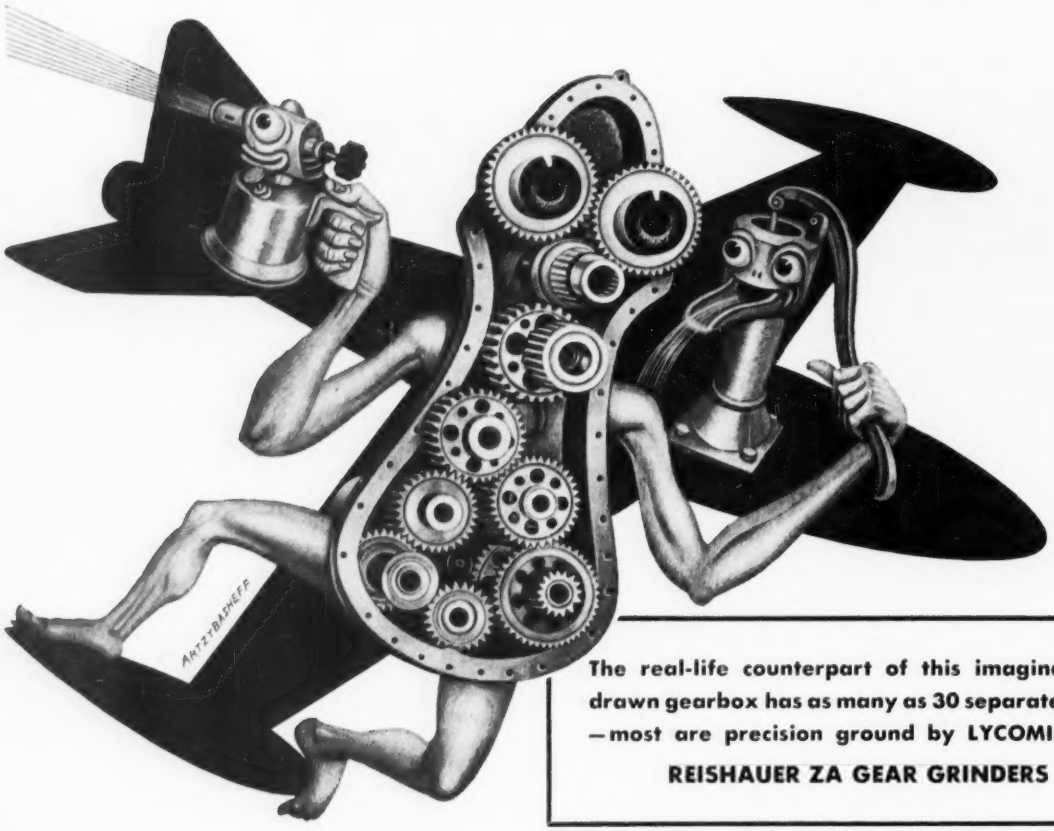
Torrington swaging experts were able to eliminate the assembly and turning of the nose piece by simply redesigning the blank tube.



Result—one swaging operation over a square mandrel, and the piece was finished except for squaring up the end.

TORRINGTON ROTARY SWAGING MACHINES

Precision gears go flying



The real-life counterpart of this imaginatively drawn gearbox has as many as 30 separate gears —most are precision ground by LYCOMING on

REISHAUER ZA GEAR GRINDERS

Single-thread grinding worm and spindle of the Reishauer ZA.

Auxiliary "nerves" of the mighty J-40 and J-47 jet engines, these precision gears transmit power to run fuel and oil pumps, generators, and other vital accessories. Lycoming, maker of this intricate gearbox, depends on Reishauer ZA gear grinders for precise, rapid production of gears.

Lycoming likes the way Reishauer consistently produces gears to extremely close tolerances at high production speeds. Furthermore, operators on the production line benefit from the simplicity and cleanliness of the machines' operation.

Lycoming is not alone in its respect for Reishauer grinders—these machines are widely used to grind spur and helical gears in the automotive and aircraft industries. Other users include machine tool builders, gear-jobbers, and instrument manufacturers.

In short, Reishauer ZA grinders are excellent machines. If you want proof, we'll be happy to supply it. Get in touch with us soon, won't you?

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools— from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA **contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.**

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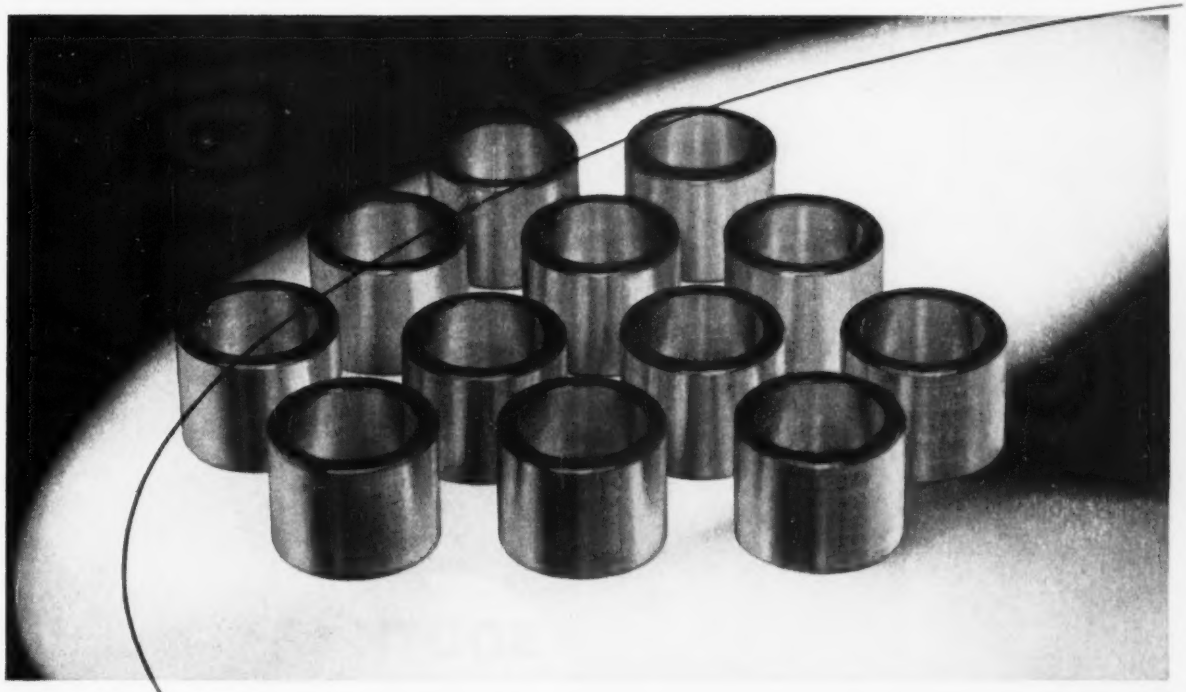

these requirements in mind...

So varied are the demands on multiple spindle automatics it is impossible to design into one model — or a number of models — all the facilities that will satisfy every requirement. To excel in any range of work the design of a machine of this type must be directed toward that work.

Cone's new General Datalog lists over forty CONOMATIC models that are designed with these requirements in mind. For any range of work, Conomatics are built to more efficiently serve the latest cutting tool materials.

data for comparison

Part	Bushing
Machine	1¼" Six Conomatic
Tools	100% Carbide Tipped
Material	Stainless Steel Tubing
Stock Size	1¼" OD; ¾" ID
R. P. M.	Work Spindle — 1033 Opposed Spindle—1048
Time	7 Seconds per Cycle 3.5 Seconds per Piece

Conomatic}

CONE AUTOMATIC
MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

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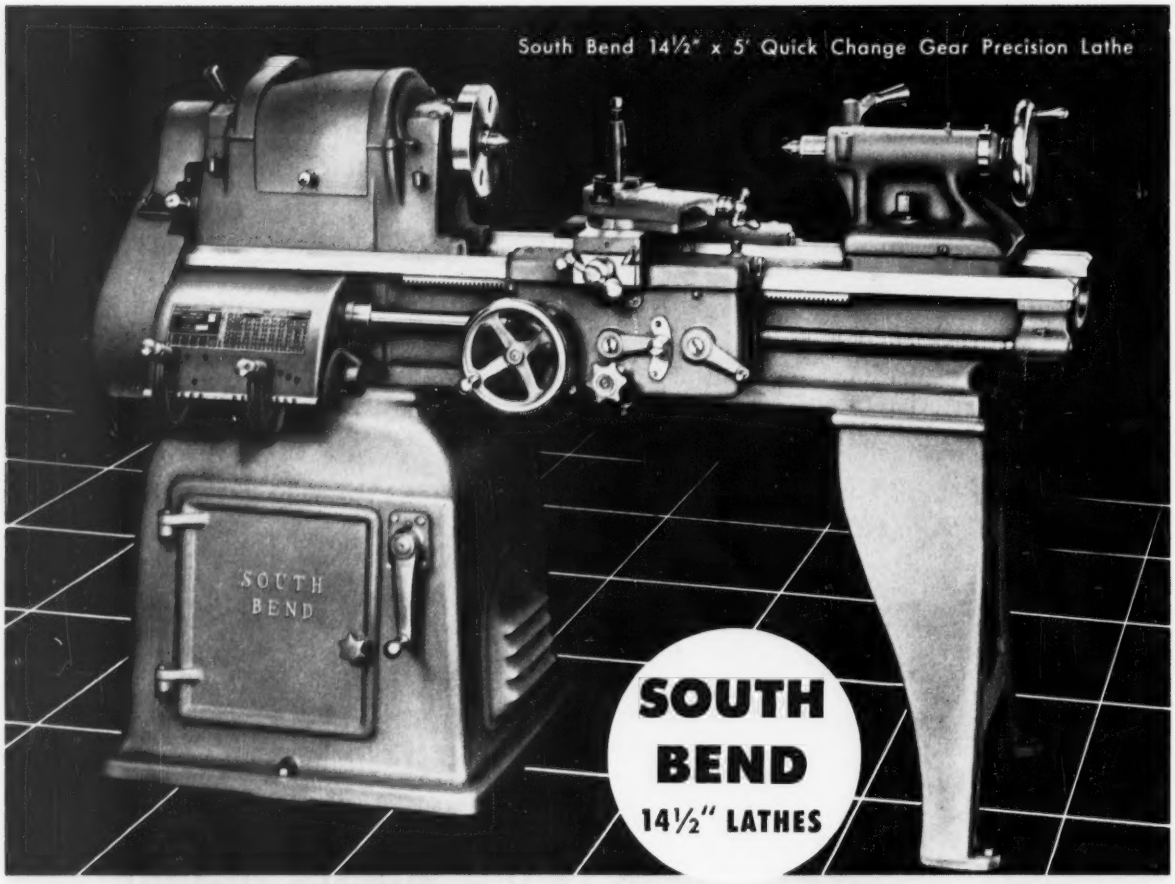


FOR FAST, PRECISION MACHINING

SPECIFICATIONS

SWINGS: 14⅝" over bed and saddle wings; 10¼" over saddle with chip guard removed.

BED LENGTHS: 5, 6, 7 and 8 feet.

DISTANCES BETWEEN CENTERS: 24½ to 60½ inches.

MAXIMUM COLLET CAPACITY: 1 inch. (Collets interchangeable with South Bend 10"-1" Collet, 13", 16" and 16-24" Lathes.)

SPINDLE BORE: 1⅛ inches.

SPINDLE SPEEDS: Eight . . . 27 to 800 r.p.m.

POWER LONGITUDINAL FEEDS: 48 R.H. or L.H., .0015" to .0841".

POWER CROSS FEEDS: 48, .0006" to .0312".

THREAD CUTTING: 48 R.H. or L.H. pitches, 4 to 224 per inch.

CROSS SLIDE TRAVEL: 10 inches.

TAILSTOCK SET-OVER: 1-5/16 inches.

CL185B, illustrated above, less electrical equipment **$1809.00**

Time payment terms: 10% down, the balance in 12 or 18 months. f.o.b. factory.

South Bend 14-1/2" Lathes offer many advantages for precision machining. Ease of operation, speed, power, accuracy, and efficiency are some of the features responsible for their popularity. Often the precision and quality of finish obtained with South Bend Lathes are such that subsequent grinding, honing, or lapping operations are unnecessary. Substantial savings in capital investment, power consumption, floor space, and labor costs have resulted from their installation.

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

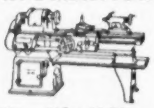
Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

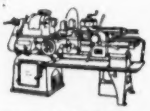
South Bend machine tools with accessories may be purchased on convenient terms up to 18 months.

PLEASE SEND INFORMATION CHECKED:

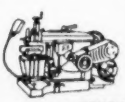
☐ 9" and 10" BENCH LATHES


☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES


☐ ½" & 1" Collet TURRET LATHES

☐ TOOL GRINDERS


☐ 7" BENCH SHAPERS

Name _____ Company _____

Street _____ City & State _____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

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2 New GLEASON TESTERS

For COMPLETE CHECKING ✓ of Small Gears

NO. 104 SPUR GEAR TESTER

for spur, helical, and internal gears up to 4½" center distance.

✓ **A ROLLING TEST for composite error, recorded in chart forms.**

✓ **A RUNNING TEST under actual operating speeds and loads.**

For complete inspection of all small gears, use both types of test. The recorded rolling test shows an exact measurement of total error, including profile, spacing, and eccentricity effects. The power running test shows how the gears perform under actual operating conditions, and permits visual inspection of tooth contact pattern.

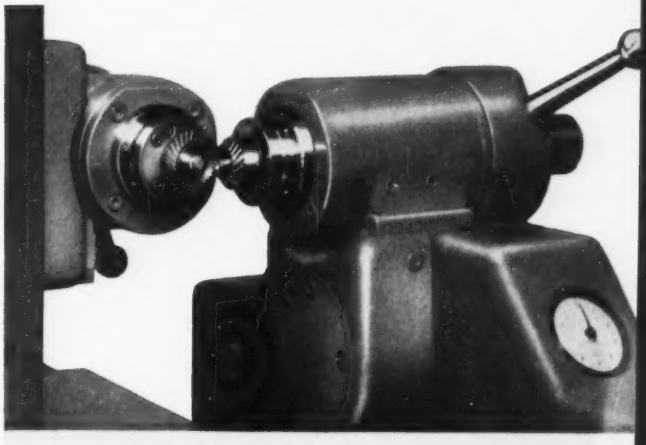
Note these provisions for making both types of check *on the same tester:*

For the RECORDING TEST

- 1/50 HP drive at 7.2 RPM
- Pressure between gears adjustable by 4 oz. increments, up to 5 lbs.
- Detachable electronic recorder with 5-stage variable magnification

For the RUNNING TEST

- ¼ HP drive
- Drive spindle speeds up to 14,000 RPM
- Precise load control by electric braking



NO. 104 ANGULAR HYPOID TESTER

for bevel and hypoid gears up to 4¼" diameter.

***WRITE FOR FULL INFORMATION** on how these new testers will improve your small gear inspection.*

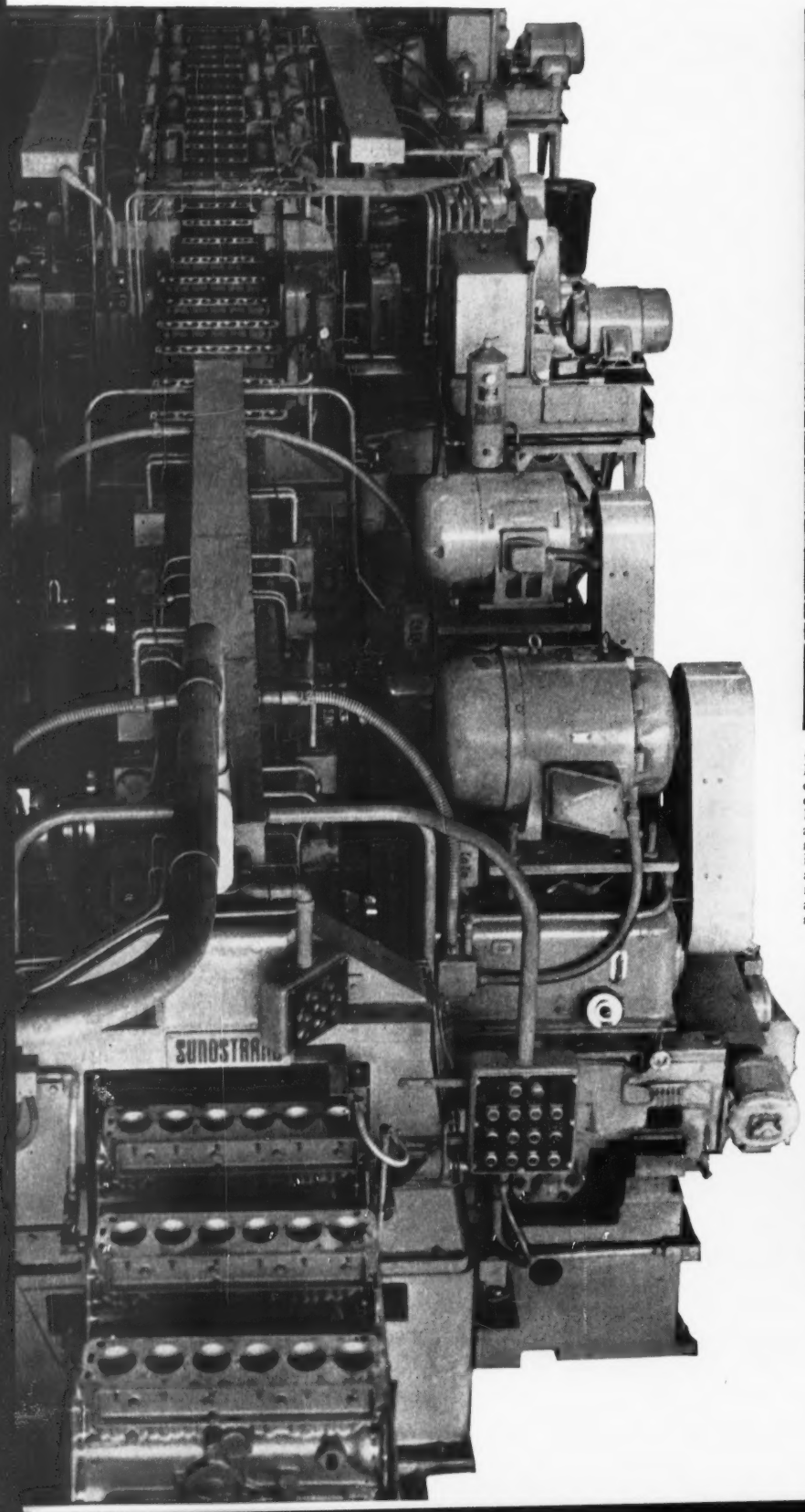
GLEASON WORKS

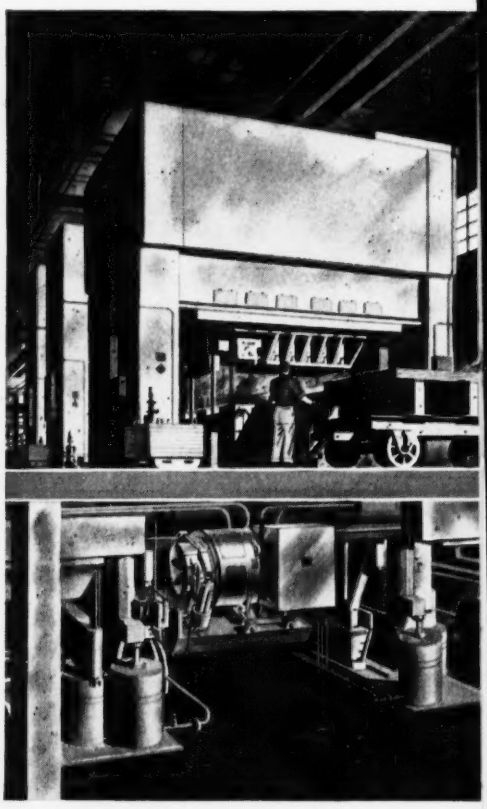
BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

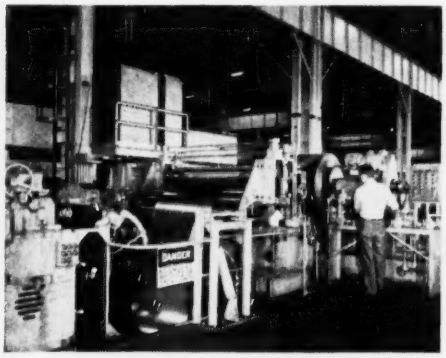
GLEASON

RELIANCE SPEEDS





(Left) Over 2000 Reliance "Precision-Built" Motors deliver steady, unfailing power to speed engine castings automatically through 26 machine operations at the Ford Cleveland Engine Plant. (Above) Adjustable speeds by the Reliance V★S System maintain record output from mammoth triple-action body presses at Ford's Buffalo Stamping Plant. Flywheel and clutch are eliminated. Starting, stopping, inching and reversing are accomplished electrically. Scrap and rejects are lower . . . die and equipment maintenance is reduced.



Reliance V★S Drive on this uncoiler permits selection of the best speed for unwinding and feeding coils automatically throughout the range of strip lengths required by various jobs and the consumption rate of the blanking press.

PRODUCTION AT FORD!

Reliance application engineering works with Ford Motor Company to coordinate motors and drives for top production efficiency in world's foremost automatic plants

The Ford Stamping Plant at Buffalo set a world production record for triple-action presses . . . the Ford Engine Plant at Cleveland increased productivity more than 50% over best previous methods. Both these outstanding plants have attained top production efficiency using Reliance motors and engineered drives . . . a Ford-Reliance engineering team operation.

In the Stamping Plant, Reliance V★S Drives are the electrical heart for critical automatic operations . . . not only in the automation processes, but also in the many individual machines whose smooth, unfailing, precisely timed operation makes automation itself possible. The versatility and dependability of the Reliance V★S Drive and its skillful application by Reliance Application Engineers have made possible better, faster, lower-cost operation . . . including setting of a world's production record for triple-action presses.

In the Engine Plant, automation hustles castings through a chain of 26 completely automatic machines which broach or mill 20 surfaces, and bore, drill, ream, chamfer, tap and counterbore 146 holes . . . to tolerances of .0005 inches. Throughout the 1545-foot production line, over 2000 Reliance Precision-Built Motor applications provide power with the necessary degree of ruggedness and dependability.

Reliance Can Help You, Too! As the user or the builder of machinery, you may have a problem that can be solved by a specially engineered drive, or by one of the many rugged Reliance industrial-duty motors. Whichever your situation, Reliance is ready to help you. A call to your nearby Reliance Sales Office . . . or a letter to us direct . . . will place at your disposal almost half a century of Reliance specialized engineering experience in the application of electric drives.

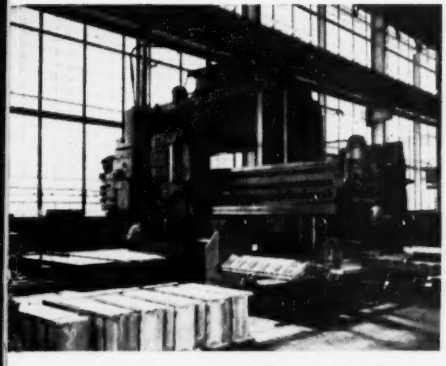
D-1473

RELIANCE Precision-Built MOTORS

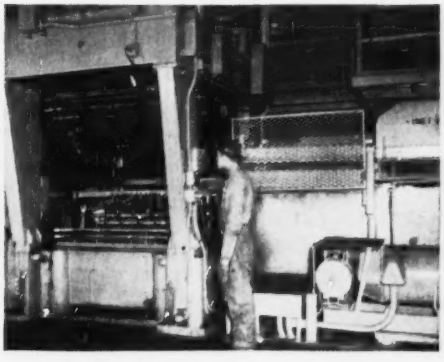
RELIANCE ELECTRIC AND ENGINEERING CO.

1077 Ivanhoe Road, Cleveland 10, Ohio • *Sales Representatives in Principal Cities*

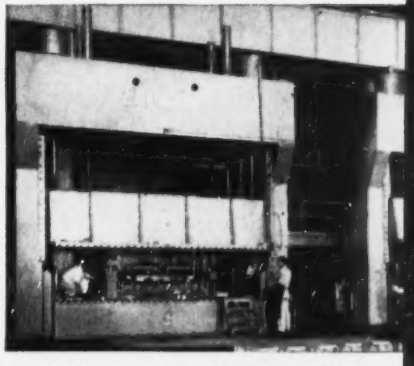
RELIANCE V★S DRIVE



On die spotters, Reliance V★S Drive provides fast speeds to minimize unproductive time on upstrokes and downstrokes. As dies approach, ram automatically decelerates to pre-set slowdown speed. When dies meet, V★S Drive automatically senses any excessive die-kiss pressure and positively stops ram before dies become cocked or damaged.

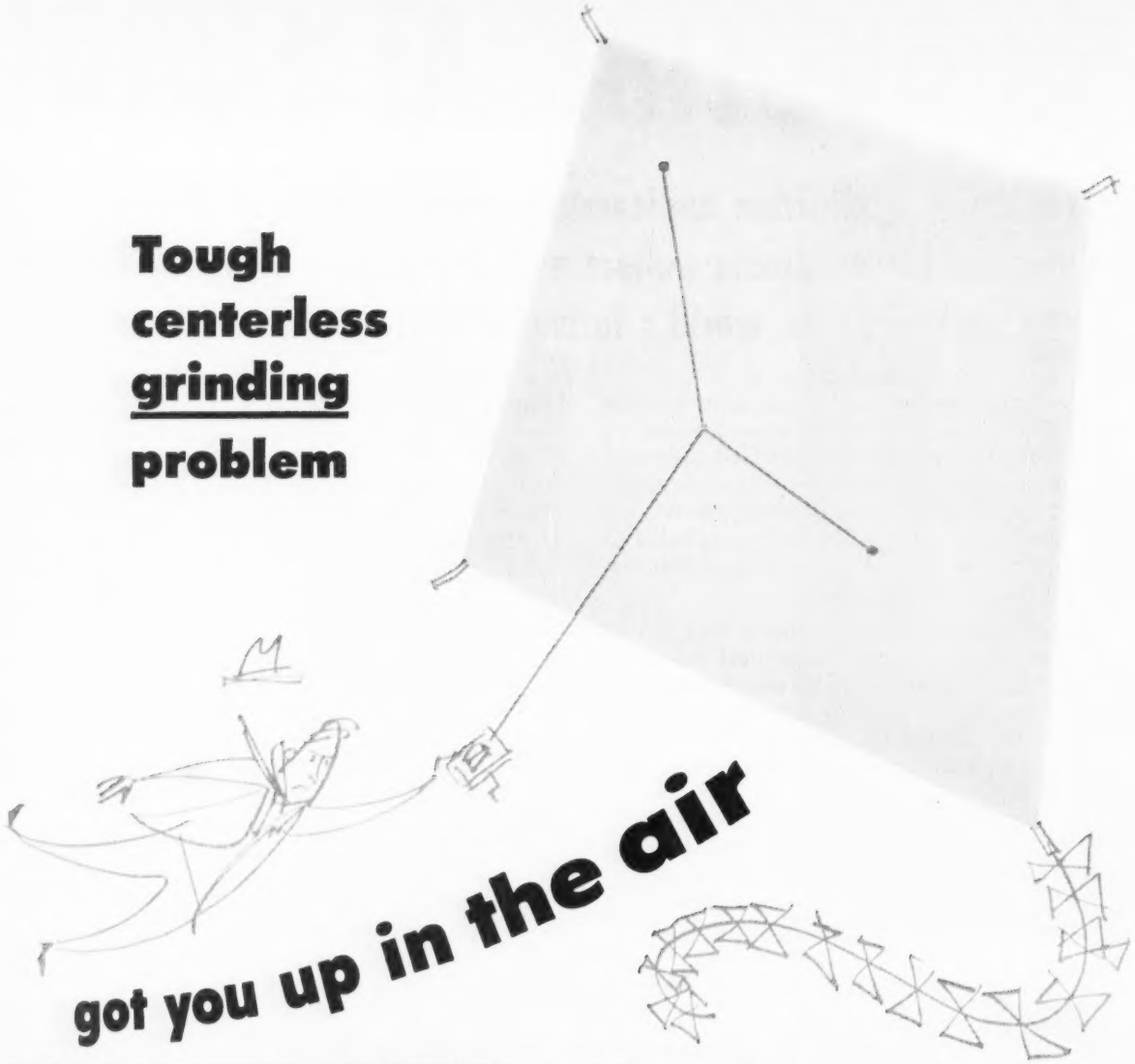


In this welding press line an automation conveyor removes parts from one operation to another on signal from limit switches actuated by the welding presses themselves. On this and similar lines, Reliance V★S Drives move 100-foot-long conveyors with one-ton loads, as much as 100 inches in 1½ seconds, and stop within limits of plus or minus ¼".



On this large, special bridge-type milling machine, Reliance V★S Drive provides two spindle speeds and three directional feeds, all adjustable over 60:1 range, with dynamic braking and complete fingertip remote control. Additional features are reduced-voltage starting, motor field acceleration, motor field-loss and overload protection, armature reversing and pre-set speeds.

Tough centerless grinding problem



got you up in the air

CINCINNATI GRINDING WHEELS and Segments are available in vitrified and resinoid bonds with aluminum oxide or silicon carbide grits.

Here's the grinding wheel that will ABSOLUTELY solve it!

Why let a tough centerless grinding problem *keep* you up in the air? CINCINNATI Grinding Wheels can help you get your feet on solid ground again . . . because CINCINNATI Wheels are *made to team-up with centerless grinders.*

What's more, with a Cincinnati Milling-trained machinist on the spot to help you get the most out of CINCINNATI Grinding Wheels, you can count on the right answer—FAST!

Here's why CINCINNATI Wheels can help you solve that tough centerless grinding problem:

CINCINNATI Grinding Wheels are used by—and *developed by*—Cincinnati Milling, which

has done more research, had more experience and made more centerless grinders than any other organization in the world.

2 Using CINCINNATI Wheels, we've solved hundreds of centerless grinding problems—such as production, roundness, taper, sizing, stock removal and finish.

3 CINCINNATI Grinding Wheels represent 25 years of Cincinnati Milling research and practical experience based on an entirely new approach to grinding wheels—the development of the grinding wheel as a true cutting tool.

We are so confident—*so absolutely sure*—that CINCINNATI Grinding Wheels can help solve your tough centerless grinding problem that we make this *unconditional offer:* either you must be completely satisfied, or we will make no charge for the CINCINNATI Grinding Wheel used.

So contact us at once. We'll send one of our expert machinists—men who are Cincinnati Milling-trained and know grinding and grinding machines as well as grinding wheels. He can show you how to get the most out of CINCINNATI Grinding Wheels and help you solve that tough centerless grinding problem. There is no charge for his service. Write, wire or phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

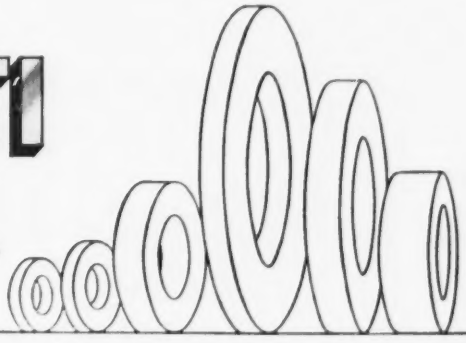
CASE HISTORY No. 501

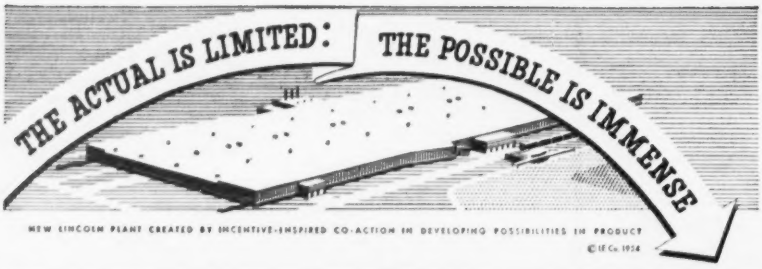
How CINCINNATI GRINDING WHEELS Solved Tough Centerless Grinding Problem

The job	Centerless grind aircraft rivets. Material - 6320 steel. Stock removal — .006" - .008" on body and .002" - .005" under head.
The machine	Cincinnati #2 Centerless.
The problem	Customer wanted to hold .010" maximum radius under the head and increase production, which was only 50 to 150 pieces per dressing.
The solution	Here is another notable solution to a difficult problem found through the use of a Cincinnati Grinding Wheel, backed up by a Cincinnati Machinist's experience in set-up and truing. The Cincinnati expert studied the problem, discussed it with production men, then prescribed a Cincinnati 2A100-N6-VL Grinding Wheel. Results: the maximum radius under the head of the rivets was held well within limits. And production was increased up to 800 pieces per dressing.

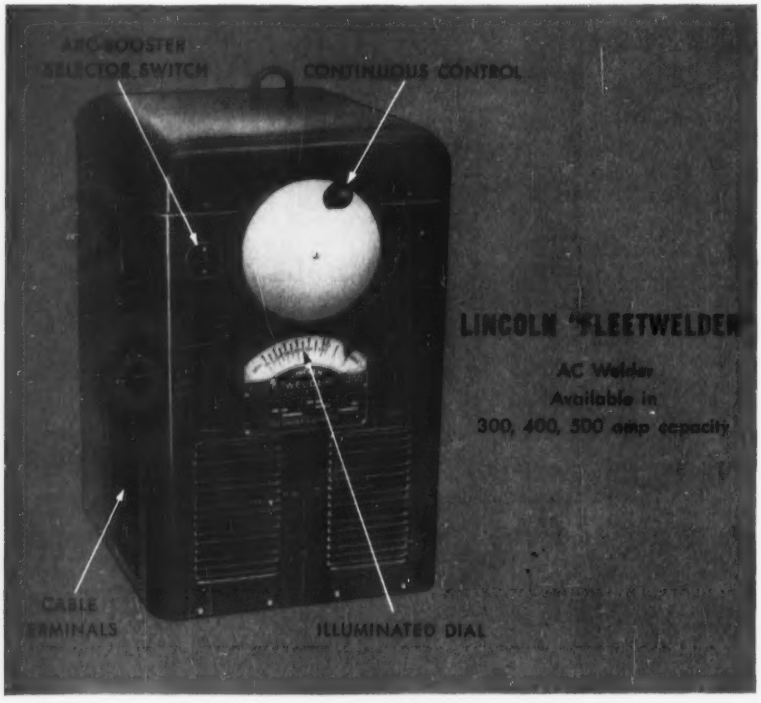
The stock removal problem in grinding aircraft rivets really had production men up in the air. A maximum radius of .010" under head had to be held and production of only 50 to 150 pieces per dressing had to be increased. For full story—and solution that increased production to 800 pieces per dressing—see Case History.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio




THE ACTUAL IS LIMITED: THE POSSIBLE IS IMMENSE
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT
©LE Co. 1954

AC WELDING MADE SIMPLER



- **Easy Current Selection.** A few turns of "Fleetwelder's" dial-operated Continuous Control select any current from a wide welding range. The exact welding current is indicated on an illuminated dial that also shows whether the machine is turned on or off.

- **Current Stays Set.** Rugged holding devices maintain accurate current settings. There are no sliding mechanisms or moving coils to become loose as the arc is struck.

- **Safe to Operate.** "Fleetwelder's" open circuit voltage is held to 71 volts for safety. Where specified, open circuit voltage can be limited to 24 volts by an optional safety contactor.

- **Arc is Self-Starting.** There is no more electrode sticking to slow up welding operations as on conventional AC machines when lighter currents and smaller electrodes are used. "Fleetwelder's" Arc-Booster starts the arc instantly each time the electrode touches the work.

- **Quality Comes Easier.** Lincoln's hot-start arc prevents cold overlaps . . . insures instant penetration at the start of every weld, an advantage for tack or plug welding.

ONLY FLEETWELDER'S HIGHER USEABLE CURRENT REALLY CUTS AC WELDING COSTS

It's so . . . By taking advantage of Lincoln's higher useable currents, you can now weld faster . . . use larger diameter electrodes to cut AC welding costs 10% and more. That is why the "Fleetwelder" starts saving money on your very first job . . . and for these reasons:

1. **Higher Useable Current** There are more *reserve* amps . . . up to 50% added current . . . in the "Fleetwelder" to put to work on your welding jobs. As a result, you get more amps per dollar with Lincoln than with any other welder.

2. **Complete Overload Protection** It is safe to operate at "Fleetwelder's" additional current because of built-in thermostats that cut out the magnetic starter . . . eliminating all danger of burn-out . . . *a feature found only in Lincoln.*

"Fleetwelder" Pays for Itself. Labor and overhead savings through "Fleetwelder's" faster operation return your investment in surprisingly short period. Have your Lincoln representative show you how. Write

SEND FOR BULLETIN

Complete description and specifications on "Fleetwelder" are in Bulletin 1314, available by writing on your letterhead.

THE LINCOLN ELECTRIC COMPANY

Dept. 1201
CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

For more information on products advertised, use Inquiry Card, page 247

EXCLUSIVE WIRE-LOKT® CONSTRUCTION

Assures Maximum Safety . . . Low Operating Costs

FAST CUTS
Corrugations speed the grinding of large area work or thin parts without burning.

FINE FINISHES
For light stock removal smooth face discs give quality finishes and close tolerances.

FULL VALUE
The entire rated thickness of the abrasive is usable.

WIRE-LOKT® SAFETY
Heavy steel mesh securely imbedded in the abrasive assures maximum safety.

117A

Gardner Abrasive Specialists give you the advantages of long experience gained from making *both* grinding machine and abrasive discs. Individual specifications will be developed to handle *your* particular grinding job.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U.S.A.

GARDNER
abrasive discs

NEW!...
For High-Precision, Economical Lapping

Here's a highly useful, yet inexpensive lapping machine, which will give to your product that last critical element of high precision and better finish. Some typical applications are the finishing of plug gages, cylindrical machine parts, mold details, fuel pump housings, and valve fittings, to mention only a few.

Designed to impart a superfine finish and long wear to ground work . . . rapidly and economically . . . it frequently eliminates the need for expensive equipment.

Yet it weighs only 600 pounds, approximately, is 37½" in height, has a 24" diameter lapping plate. Plates are finished either plain for cylindrical lapping or grooved for flat work. To ensure top precision, they are carefully machined from a special close-grained cast iron, carefully heat treated to prevent seasonal distortion.

Write *today* . . . for information on the many other features of this brand new machine.

The Taft-Peirce Manufacturing Company
WOONSOCKET, RHODE ISLAND

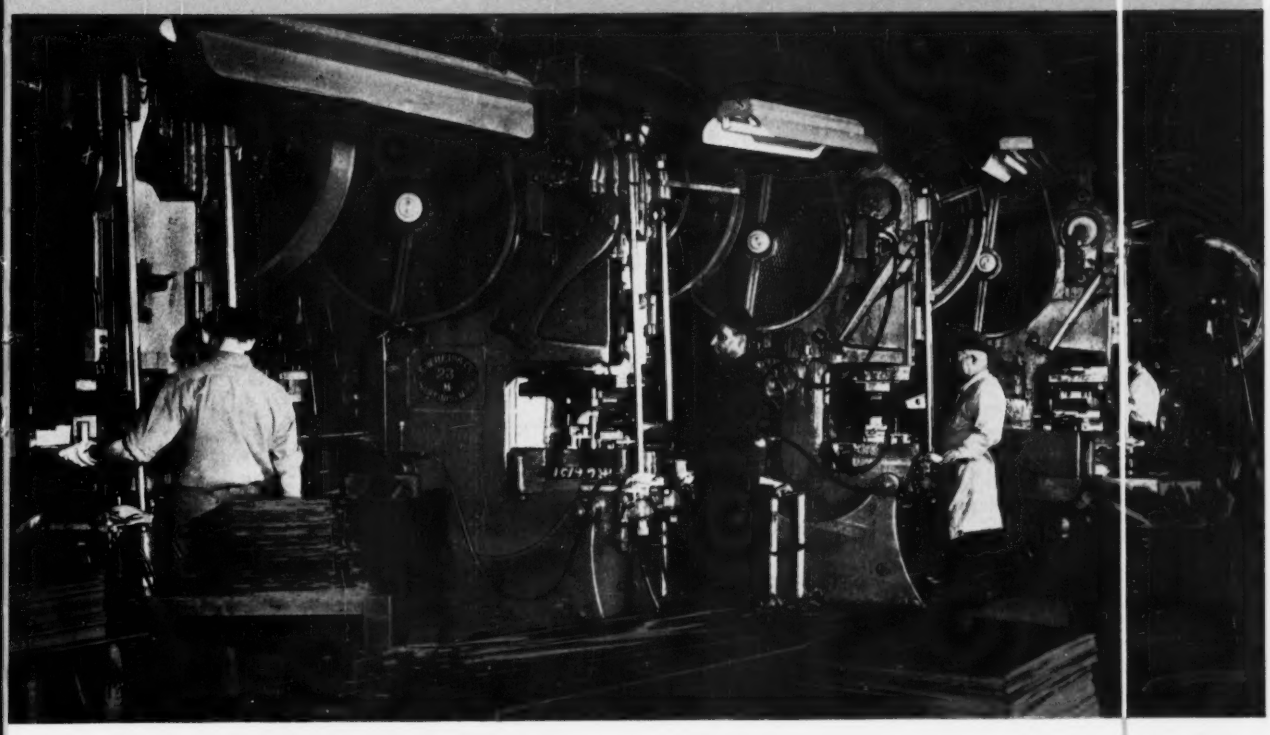
Lapping a plug gage on a Taft-Peirce Lapping Machine.

T-P means TOP PRECISION

For more information on products advertised, use Inquiry Card, page 247

At Art Steel Company, too,

BLISS Presses Predominate



97% are Bliss-Built

Now, Art Steel Company, one of the leading manufacturers of steel office equipment — *Steelmaster* — credits Bliss with an important role in its progress. For Art Steel as looked to Bliss since 1923 for engineering counsel nd the right press for each operation. Seventy-three Bliss presses making up 97% of Art Steel's press quipment attest to the fact that Bliss has justified his confidence.

Asked *why the continued preference for Bliss* ›esses, Art Steel officials sum it up in one word — *"dependability"*.

And that's why hundreds of sheet metal plants hroughout this country and abroad specify Bliss ›resses more than any others. Whether your requirements involve mechanical or hydraulic presses . . . high speed or normal speed . . . straight side or gap frame . . . it pays to call for a Bliss engineer. He can show you why Bliss belongs in *your* press room, too.

E. W. BLISS COMPANY, CANTON, OHIO

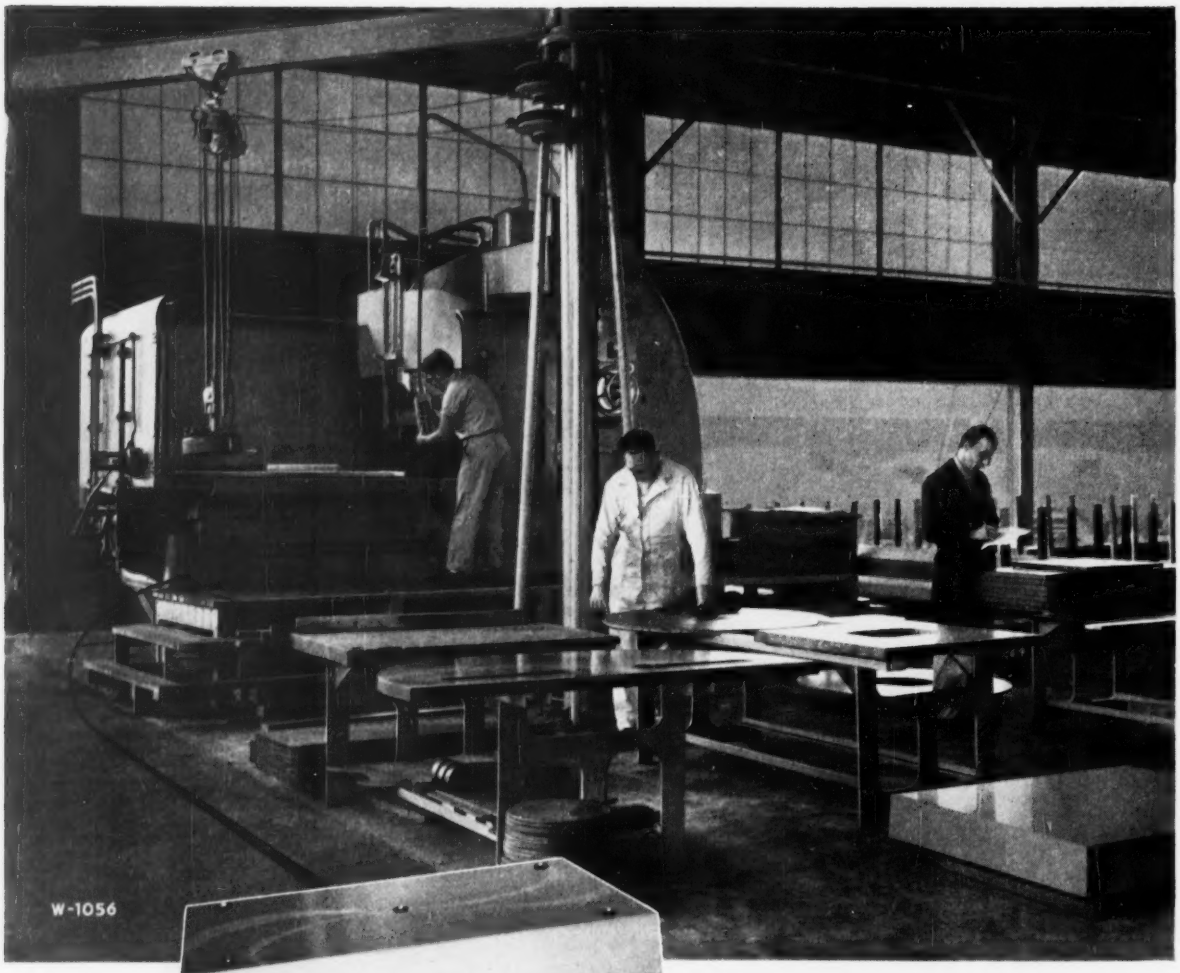
E. W. Bliss (England) Ltd., Derby, England

E. W. Bliss Company (Paris), St. Ouen sur Seine, France

U. S. Plants in Canton, Salem and Toledo, Ohio; and Hastings, Michigan. Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. West Coast Representatives: Moore Machinery Co., Los Angles and San Francisco; Star Machinery Company, Seattle. Other representatives throughout the world.

• • •

BLISS on your press is more than a name ...it's a guarantee!



Takes on all comers!

This 42-72-84 Blanchard Surface Grinder is used for machining many sizes of torch cut steel plates. As the first operation after cutting, Blanchard grinding removes the proper depth of stock as required, frequently up to ⅛" per side, producing surfaces accurately flat and parallel for laying out or further machining. Work up to 7 feet across corners is regularly ground on this machine. In spite of its size, this grinder is as easily controlled as the smaller Blanchard grinders.

Typical of work produced is the 48" x 48" x 10" machine steel, die mounting plate, at left. 58 cu. in. of stock (.025" per side) is ground off in one hour and 35 minutes, floor to floor, with flatness held to .001". Note the magnetic hoist —a good tip for loading and unloading the Blanchard quickly.

Regardless of your requirements for stock removal, tolerances or surface finish, Blanchard has the grinder and grinding wheel to do each job best.

Send for your free copies of "Work Done on the Blanchard," fourth edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

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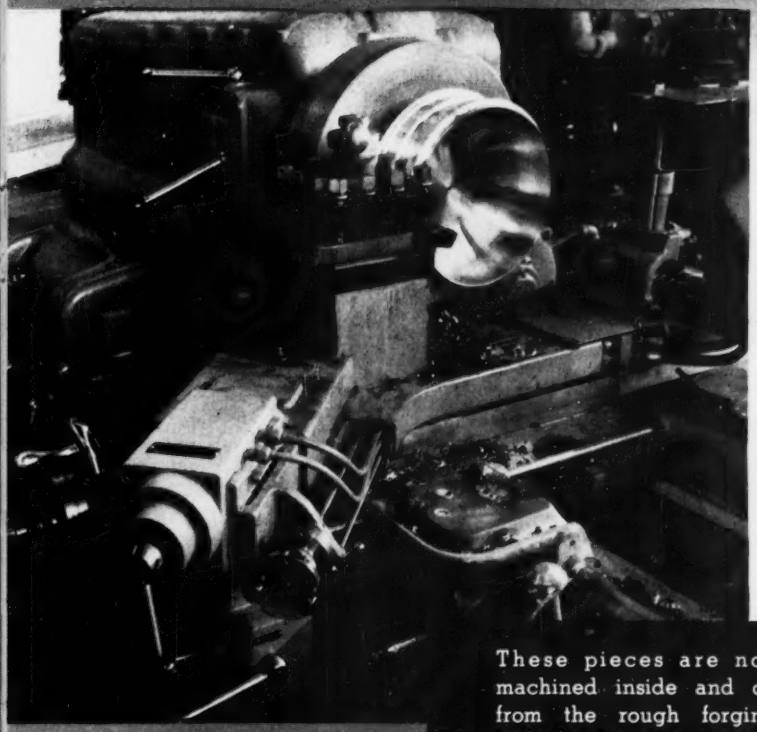
Rheem solves a "toughie"

and increases production *three hundred per cent*

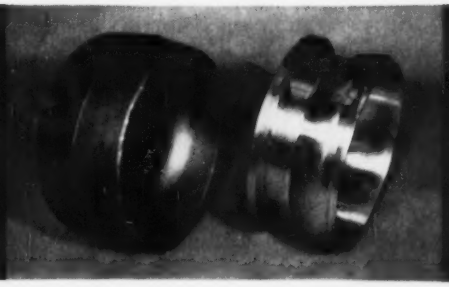


Machining the various contours of these guided missile components with the accuracy and finish required was a problem that Rheem Mfg. Co., Aircraft Division at Downey, California, had to lick.

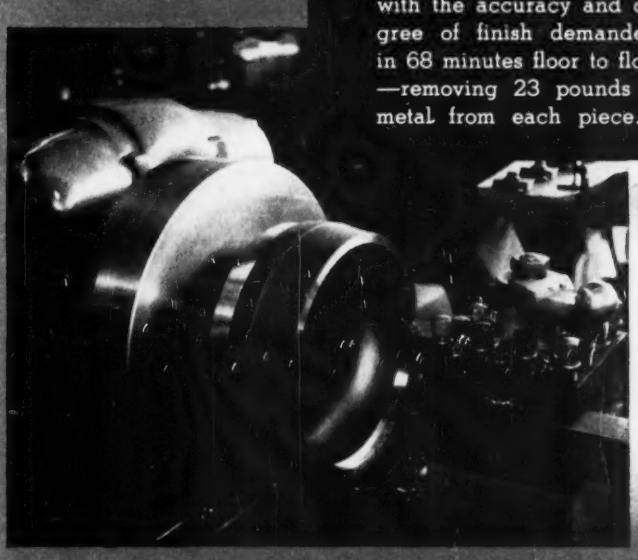
The answer . . .

"AMERICAN"

HYDRAULIC DUPLICATING LATHES



These pieces are now machined inside and out from the rough forging, with the accuracy and degree of finish demanded, in 68 minutes floor to floor —removing 23 pounds of metal from each piece.

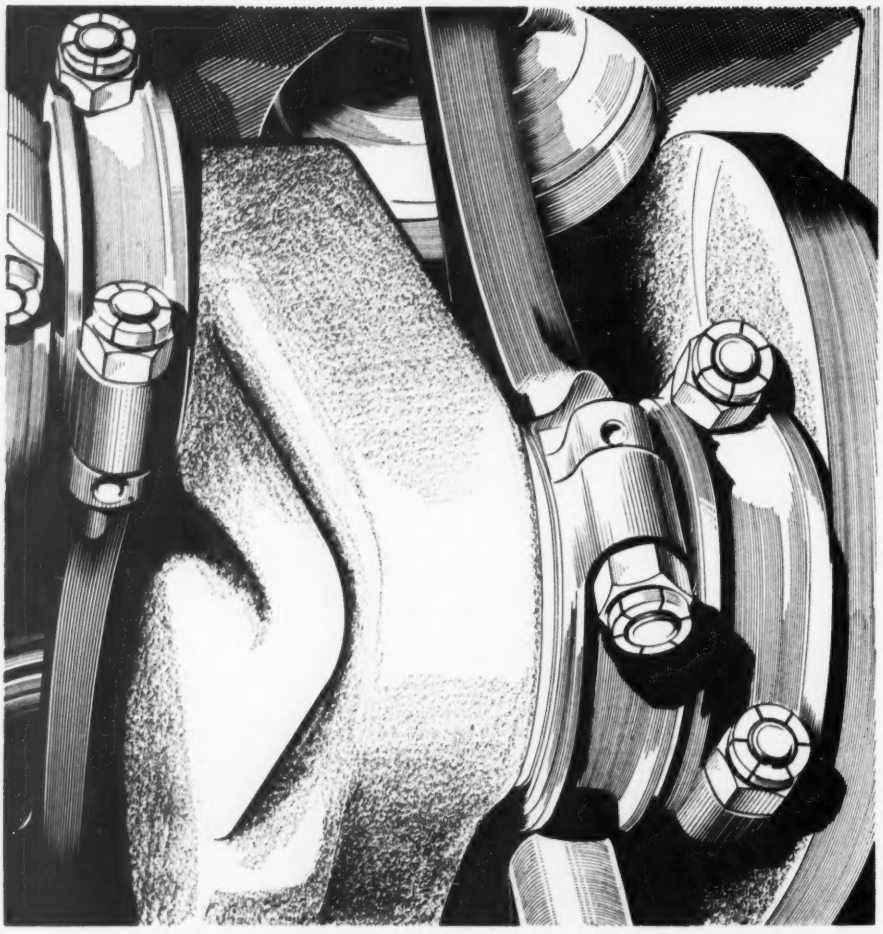


The simplicity and dependability of the duplicating equipment plus the power and sturdiness of the "AMERICAN" Lathe proved just the right combination for this difficult job.

We specialize in "tough ones" —better ask us about your "problem" jobs.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



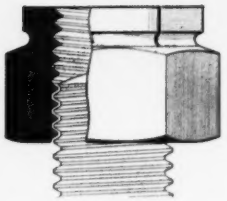
More and more automotive repair shops and industrial plants are turning to FLEXLOCs to reduce maintenance on high speed, vibrating equipment.

FLEXLOC locknuts save $600 per year in reconditioning automobile engines

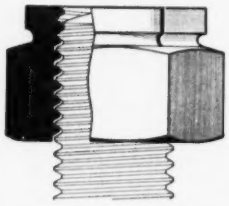
By using FLEXLOCs on connecting rod bolts, a motor reconditioning shop cut assembly time by a minimum of 5 minutes per motor. This added up to a yearly saving of 250 hours or $600. No drilling of bolts was needed . . . no adjusting of nuts to set cotter pins was required. And the FLEXLOCs assured a tighter assembly than was possible with the castellated nuts and cotter pins formerly used.

FLEXLOC locknuts reduce maintenance too. Once they are installed, you can forget them. Service and inspection periods can be stretched safely from days to weeks. And FLEXLOCs are reusable. They can be applied again and again without losing locking efficiency.

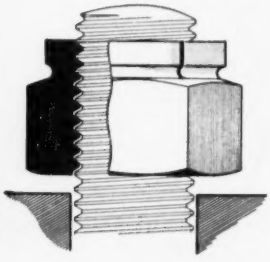
You can get FLEXLOC Self-Locking Nuts of various types and materials in a wide range of sizes and in any quantity. These one-piece, all-metal nuts are carried in stock by leading industrial distributors everywhere. Write for literature and samples for test purposes. STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.



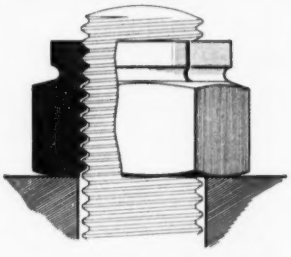
Starting. A FLEXLOC starts like any ordinary nut. Put it on with your fingers. Tighten it with a standard hand or speed wrench.



Beginning to Lock. As the bolt enters the segmented locking section, the section is expanded, and the nut starts to lock.



Fully Locked As a Stop Nut. When 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC is fully locked. A FLEXLOC does not have to seat to lock.



Fully Locked As a Seated Nut. When it is used as a lock or stop nut, the locking threads of the FLEXLOC press inward against the bolt, lifting the nut upward and causing the remaining threads to bear against the lower surface of the bolt threads. Vibration will not loosen a FLEXLOC, yet there is no galling of threads.

FLEXLOC LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

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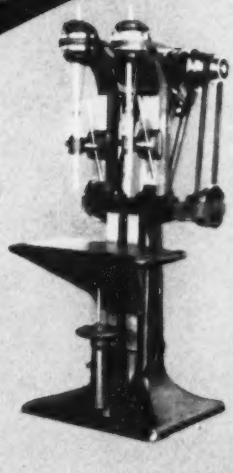
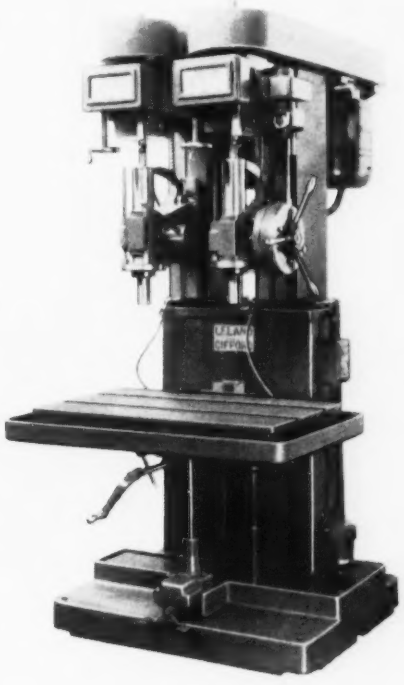
The Big Difference is in your PROFIT!



1913



1953

You can see at a glance that the new Leland-Gifford Drilling Machine is equipment any shop would be proud of — inspiring operators to do their best and lending a look of modern efficiency to the plant.

Heavier and more rugged than the old drilling machine; it has individual motor drive in place of the belt drive; radial and annular thrust bearings instead of plain thrust bearings, oil mist lubrication replacing open lubrication and multi-spline spindles where single spline spindles were used.

But the big difference is in your profit. Today's pace demands faster production and greater accuracy. Modern Leland-Gifford Drilling Machines have what it takes not only to keep you ahead today, but to enable you to operate at a profit in the face of even higher standards which may be expected tomorrow.

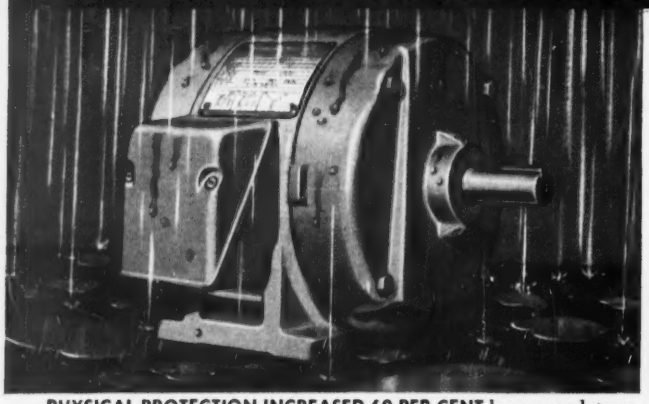
Write For Complete Information

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

YOU GET EVEN LONGER MOTOR LIFE



PHYSICAL PROTECTION INCREASED 60 PER-CENT by a complete redesign of cast-iron frame and end shields. This motor is suitable for many jobs where ordinary dripproof motors should not be applied.

EXTRA ELECTRICAL STRENGTH is assured by use of new polyester film insulation. A silicone coating, Dri-film,* virtually eliminates stator insulation failure caused by moisture.

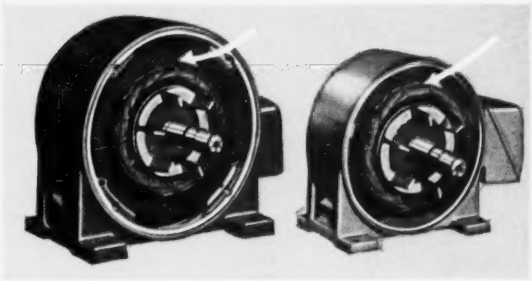
*REG. U.S. PAT. OFF.

TRI-CLAD THE LEADER IN MODERN MOTOR DESIGN

GENERAL ELECTRIC ANNOUNCES...

THE ALL-NEW TRI 55 CLAD MOTOR

REG U.S. PAT OFF.



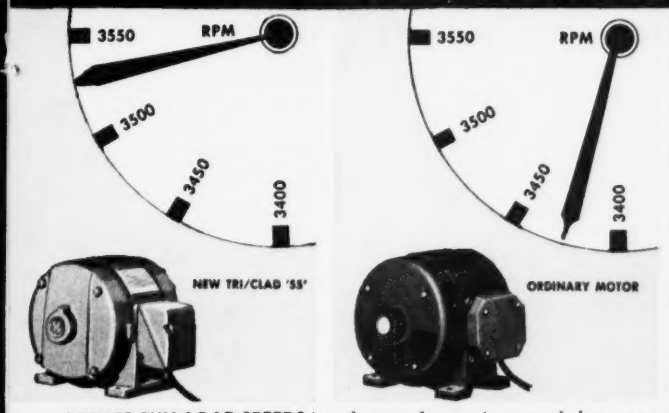
LIGHTER, SMALLER Tri/Clad '55' motors have been made possible through better use of space within the frame. Active materials (magnetic steel, copper) have not been sacrificed.

Complete Line of Dripproof, Enclosed Motors and Gear-Motors Available in Most Ratings in 1954

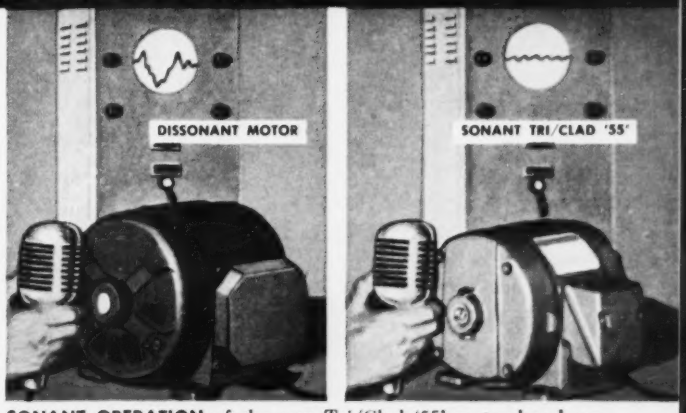
Here's the all-new Tri/Clad '55' motor — now available in NEMA 182 and 184 frame sizes.

You can get complete information on this dramatic motor achievement by writing for bulletin GEA-6013 on Tri/Clad '55' Dripproof motors, GEA-6012 on Tri/Clad '55' Enclosed motors, or GEA-6027 on Tri/Clad '55' Gear-motors, or by contacting your nearby G-E Apparatus Sales Office or G-E Motor Agent. General Electric Company, Section 648-1, Schenectady 5, N. Y.

YOU GET EVEN BETTER PERFORMANCE



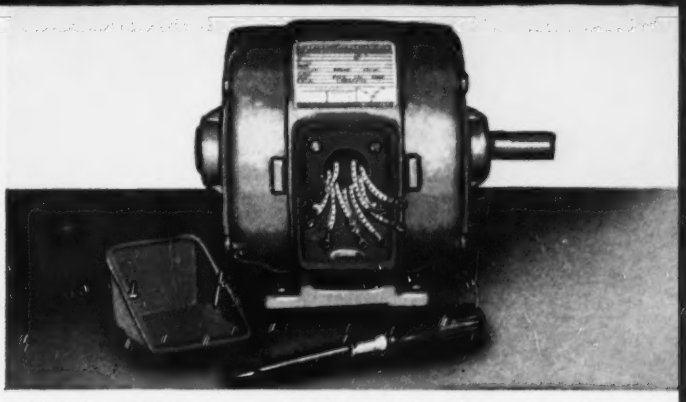
HIGHER FULL-LOAD SPEEDS is only one of many improved characteristics of this new G.E. motor. Above shows comparison of an ordinary motor with the Tri/Clad '55' — both rated at 3600 rpm.



SONANT OPERATION of the new Tri/Clad '55' motor has been laboratory tested and proven. Motor operates at reduced noise level, and operating sound is pitched to a more pleasant frequency.

YOU GET EVEN MORE INSTALLATION AND MAINTENANCE SAVINGS

NEW BEARING SYSTEM allows this motor to run longer than other motors without regreasing. One reason—greatly improved synthesized grease with 8 times the mechanical stability of ordinary grease.



EASIER TO SERVICE, the new Tri/Clad '55' has larger conduit box diagonally split for simplified wiring. Perma-numbered leads mean that even clipped and stripped wires are instantly identified.

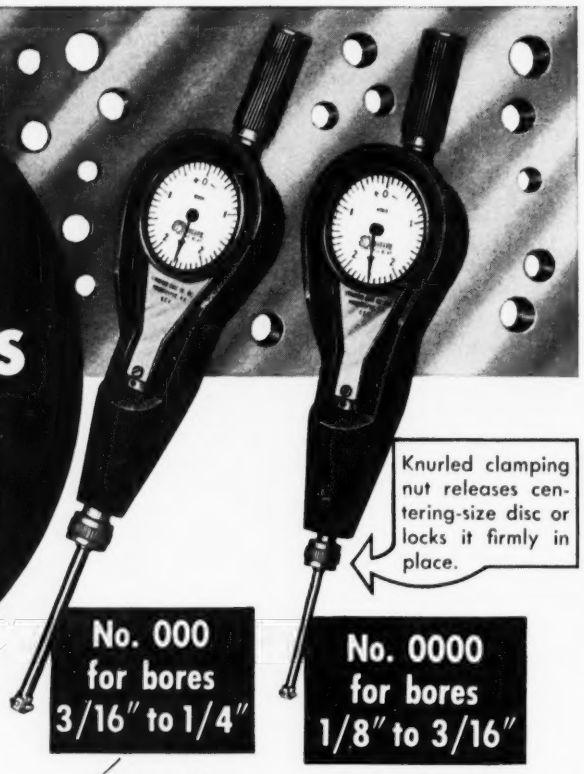
Progress is our most important product

GENERAL ELECTRIC

NOW!—DOWN TO 1/8″

Two New Dial Bore Gages

for measuring 1/8″ and 3/16″ bores

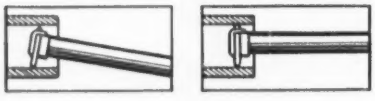

Knurled clamping nut releases centering-size disc or locks it firmly in place.
No. 000 for bores 3/16″ to 1/4″
No. 0000 for bores 1/8″ to 3/16″

Patent Applied For

These two new STANDARD developments extend the effectiveness of STANDARD Dial Bore Gages to quick, accurate, quantitative inspection of bores down to as small as ⅛″ diameter. They utilize the "centering-size disc" principle, tested-in-use with similar but slightly larger gages.

* Hold settings positively
* Give reliable repeat readings
* Sapphire tipped gaging plungers and chrome-plated centering-size disc insure long gaging life
* High visibility dial graduations of .0001 are easy to read
* "Capstan" adjusting disc facilitates adjustment when zeroing instrument.

EASE OF OPERATION



Gage is entered at an angle to allow extended plunger to clear the bore, then rocked to cause plunger to pass a square position while noting minimum reading on the indicator.

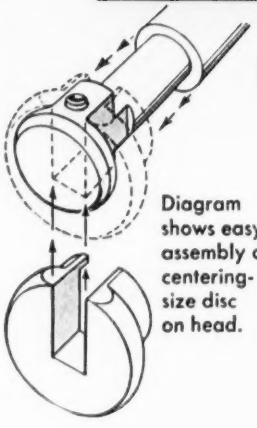


Diagram shows easy assembly of centering-size disc on head.

EASY "SIZE CONVERSION"

Conversion to various sizes in the over-all range of the gage is accomplished by the quick interchange of centering-size discs on the same head simply by turning the knurled clamping nut. Positive interlocking action insures holding set dimension. Centering-size discs are furnished to fit bore dimensions specified by the user, or in complete sets.

AVAILABLE AS ONE-DIMENSION OR FULL-RANGE GAGE

When either gage is supplied with set of discs, any dimension within its over-all range can be measured with a tolerance up to plus or minus .002″.

STANDARD Dial Bore Gages now in 10 sizes covering range from ⅛″ to 16″

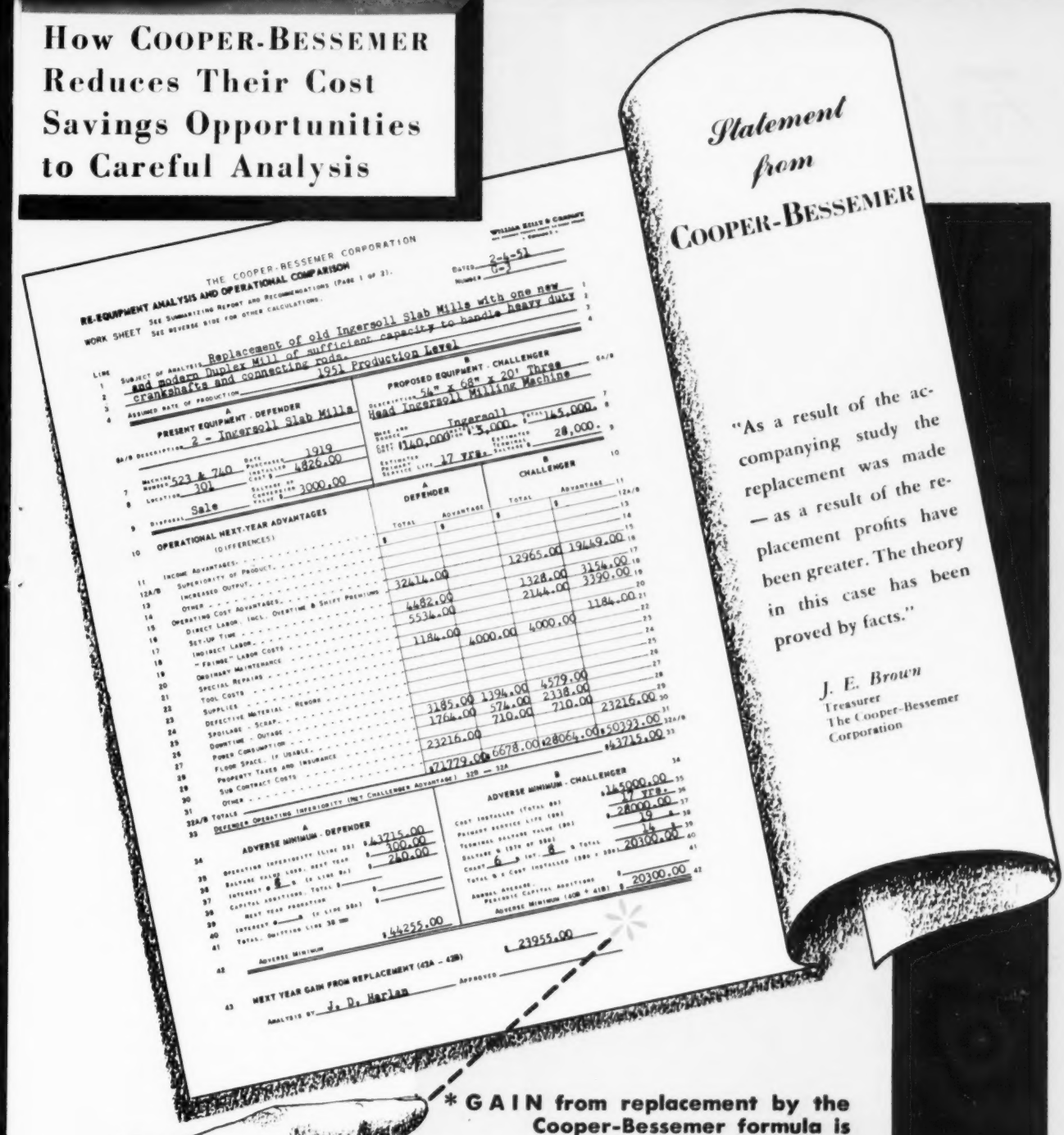
Write for full details

STANDARD Gage Co., Inc.

POUGHKEEPSIE, N.Y.

For more information on products advertised, use Inquiry Card, page 247

How COOPER-BESSEMER Reduces Their Cost Savings Opportunities to Careful Analysis



THE COOPER-BESSEMER CORPORATION

RE-EQUIPMENT ANALYSIS AND OPERATIONAL COMPARISON (PAGE 1 OF 2).

WORK SHEET — See Summarizing Report and Recommendations — See reverse side for other calculations.

Dated 2-4-52

Subject of Analysis: Replacement of old Ingersoll Slab Mills with one new and modern Duplex Mill of sufficient capacity to handle heavy duty crankshafts and connecting rods.

Assumed Rate of Production: 1951 Production Level

A — PRESENT EQUIPMENT - DEFENDER

6A/B Description: 2 - Ingersoll Slab Mills

Machine Number: 523 & 740 — Date Purchased: 1919

Location: 301 — Installed Cost $: 4826.00

Disposal: Sale — Salvage or Conversion Value $: 3000.00

B — PROPOSED EQUIPMENT - CHALLENGER

Description: 54" x 68" x 20' Three Head Ingersoll Milling Machine

Make and Source: Ingersoll — Cost: $140,000 — Estimated Delivery: 13 mos. — Estimated Installed Cost: $145,000. — Estimated Terminal Salvage $: 20,000.

Estimated Primary Service Life: 17 yrs.

OPERATIONAL NEXT-YEAR ADVANTAGES (DIFFERENCES)

	A DEFENDER Total $	A DEFENDER Advantage $	B CHALLENGER Total $	B CHALLENGER Advantage $
Income Advantages: Superiority of Product				
Increased Output			12965.00	19449.00
Other	3244.00		1328.00	3156.00
Operating Cost Advantages: Direct Labor - Incl. Overtime & Shift Premiums	4482.00		2144.00	3390.00
Set-up Time	5534.00			1184.00
Indirect Labor	1184.00			
"Fringe" Labor Costs		4000.00	4000.00	
Ordinary Maintenance				
Special Repairs				
Tool Costs				
Supplies	3185.00	1394.00	4579.00	
Defective Material - Rework	1764.00	574.00	2338.00	
Spoilage - Scrap		710.00	710.00	
Downtime - Outage				23216.00
Power Consumption	23216.00			50399.00
Floor Space - If Usable				
Property Taxes and Insurance				
Sub Contract Costs				
Other				
32A/B Totals	$71279.00	$6678.00	$28064.00	$43715.00

Defender Operating Inferiority (Net Challenger Advantage) 32B — 32A

A — ADVERSE MINIMUM - DEFENDER

Operating Inferiority (Line 33)	$43715.00
Balance Value Loss: Next Year	300.00
Interest @ 6 % (x Line 8a)	240.00
Capital Additions: Total $	
Next Year Production	
Interest @ % (x Line 38a)	
Total: Omitting Line 38	
Adverse Minimum	$44255.00

B — ADVERSE MINIMUM - CHALLENGER

Cost Installed (Total $)	$145000.00
Primary Service Life (Yrs)	17 yrs.
Terminal Salvage Value ($)	$ 28000.00
Balance @ (87% or 88%)	19
Years @ 6 % Int.	6
Total	25
Total $ x Cost Installed (39b x 39a)	$ 20300.00
Annual Average Periodic Capital Additions	$ 20300.00
Adverse Minimum (40B + 41B)	$ 23955.00

NEXT YEAR GAIN FROM REPLACEMENT (42A - 42B)

Analysis by: J. D. Harlan — Approved

Statement from COOPER-BESSEMER

"As a result of the accompanying study the replacement was made — as a result of the replacement profits have been greater. The theory in this case has been proved by facts."

J. E. Brown
Treasurer
The Cooper-Bessemer Corporation

*** GAIN from replacement by the Cooper-Bessemer formula is**

. . . after required interest or return on the new investment

. . . after full allowance (by the formula) for future obsolescence of the new equipment

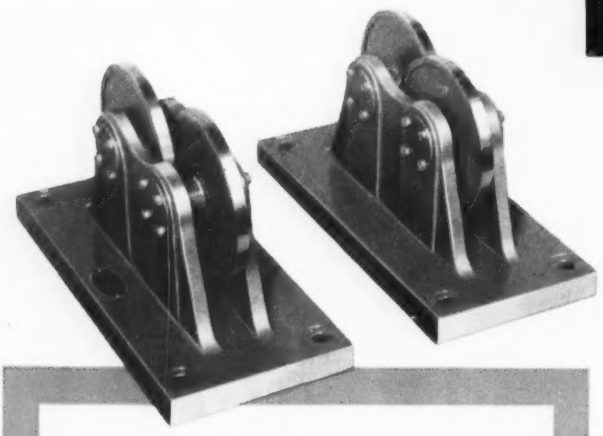
Keep Gathering Metal-Working Production Ideas...Be Well Informed When The Time For Replacement Arrives . . . . . .

March, 1954

ROCKFORD INSERT GROUP

For lowest cost...

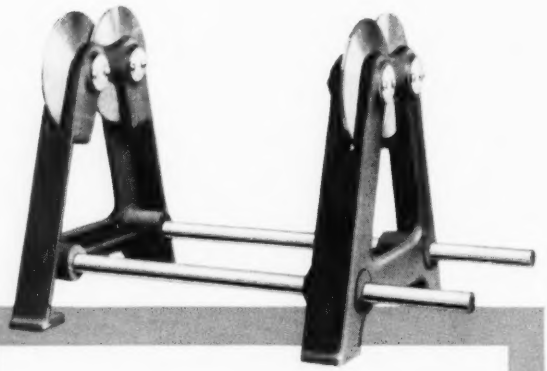
PRECISION BALANCING



You profit from precision by using Anderson improved balancing ways in your balancing, straightening, and truing operations. They are ready to use . . . no leveling . . . no centering. In a fraction of the time needed for trial-and-error methods, they prove balance or detect error. AND supersensitive precision is designed and built into Anderson balancing ways. The revolving chilled discs and their spindles are ground and polished to extreme accuracy. Spindles and bushings are glass-hard. Pillow Block or Stand Type Balancing Ways are available to fit your needs.

PILLOW BLOCK BALANCING WAYS

Anderson Pillow Block Balancing Ways are designed for large-diameter work. They can be quickly attached to any sub-base that will allow the necessary clearance. Though precision-made to detect the slightest discrepancy in balance, Anderson Blocks can handle weights from 1,000 pounds to 20,000 pounds. They have proved themselves in thousands of plants throughout the world, and their precision and simple operation gain new users daily.



- **INCREASED PRODUCTION**
- **LOWER COST**
- **BETTER WORK**

STAND BALANCING WAYS

Anderson Stand Type Balancing Ways will handle work weighing from 1,000 pounds to 10,000 pounds, and with a diameter up to 96". Distance between stands can be adjusted from 20" to 88". Longer shafts are available on special order. Write today for Bulletin 3-6 which gives complete information, on both Pillow Block and Stand Balancing Ways. Anderson Ways are proved for precision.

Anderson

ANDERSON BROS. MFG. CO.
ROCKFORD, ILLINOIS

Write for Bulletin 3-6

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

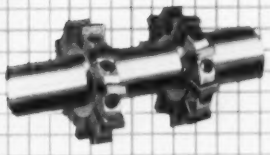
120 H.P.—MILLING SLOTS

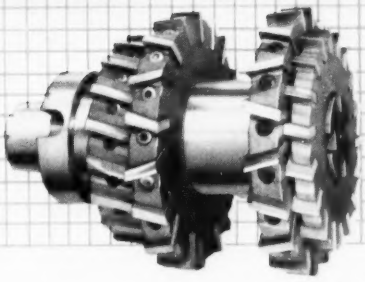
1¼" WIDE, 3¼" DEEP, 20" FEED

This unusual operation with 24" Ingersoll carbide inserted blade slotting cutters is an example of the kind of experience we draw upon when recommending and building arbor cutters for slotting and straddle milling on either light or heavy machines. Cutters of this type are made as small as 4" x 3/8".

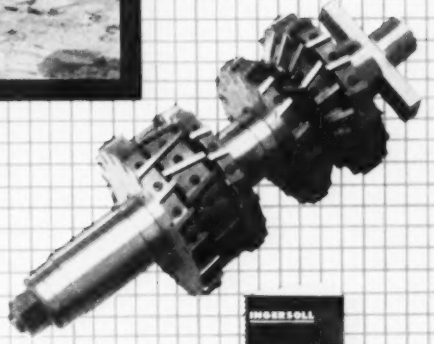
Ingersoll cutter engineers are available to help you multiply returns on large investments in production machinery with efficient tooling.

Have you compared the economy of replacing a set of inserted blades instead of buying a complete new solid cutter? The saving is substantial.





There are many opportunities for substantial savings in this class of work by using combinations of cutters to machine a number of surfaces in one pass.



WRITE FOR Catalog 608, describing Ingersoll Inserted Blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters, and boring heads.

THE INGERSOLL MILLING MACHINE COMPANY

ROCKFORD, ILLINOIS, U.S.A.

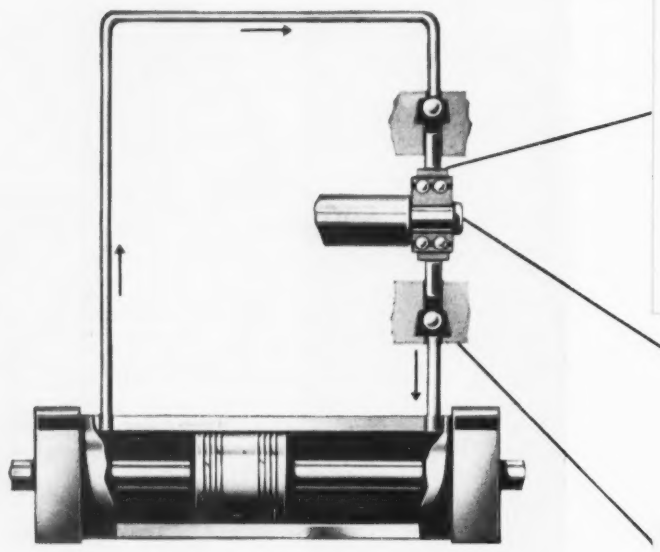
BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

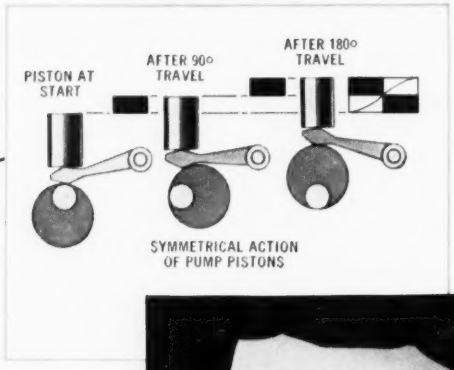
ORIGINATORS OF SHEAR CLEAR CUTTERS

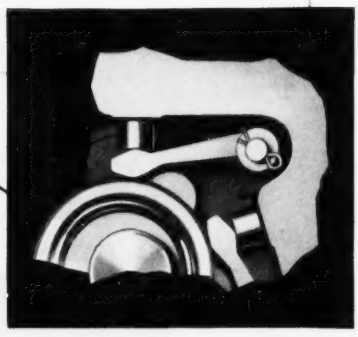
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

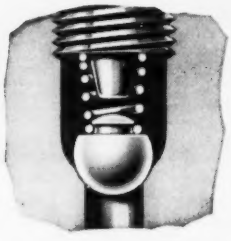
alone

BARNES CLOSED *FLUID* CIRCUIT









Circuit consists of an actuator having a relatively shiftable piston; a variable displacement pump propelling the actuator at selected speeds; and sealed ducts leading from the actuator to the pump and from the pump to the actuator. This arrangement causes fluid to be sealed within the circuit and maintains fluid pressure on both sides of the actuator. Result — positive control of travel of the actuator piston.

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3931 W. Slawson Ave.
Los Angeles 43, California

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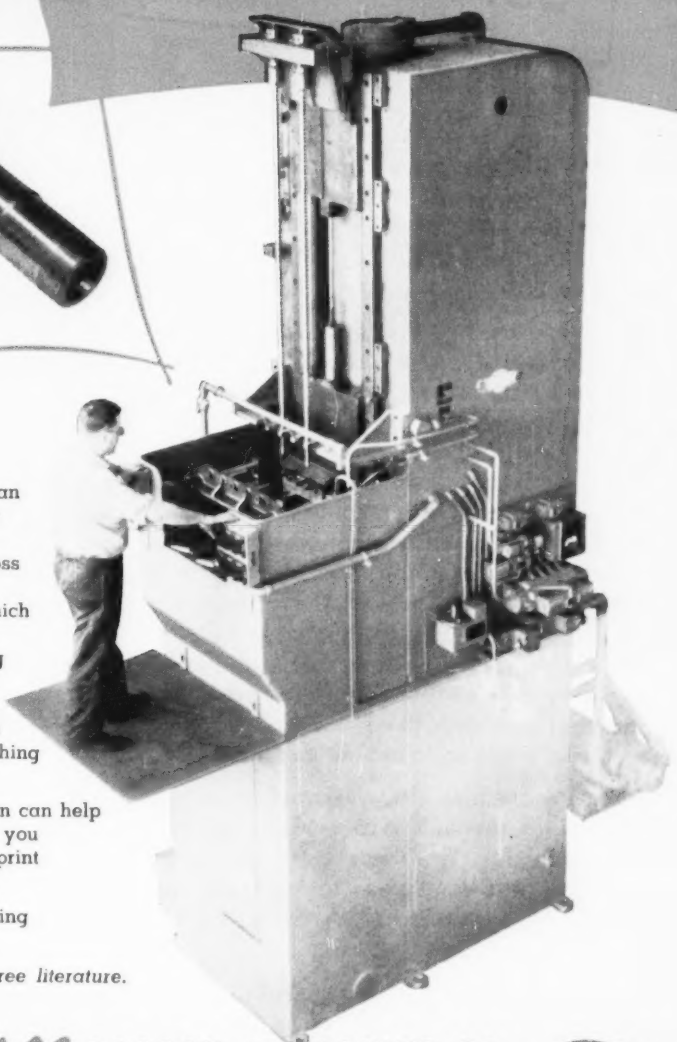
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

FASTER SPLINE BROACHING

the *American* way

Check these broaching features that make it possible...

- ✓ Multiple station set-up
- ✓ Load while broaching
- ✓ Hydraulic transfer slide
- ✓ Automatic ejection of parts
- ✓ Interchangeable tooling for several parts



Splined holes are broached simultaneously in five parts in one pass on this five-station American 40-Ton 72" stroke pull-down machine. A transfer slide permits the operator to reload parts during the broaching cycle. The parts are loaded on cross hole locating pins mounted on the transfer slide, and then moved into stationary holding jaws, which hold them in broaching position. The slide then moves back allowing the operator to reload during the broaching stroke. After broaching the parts are automatically ejected from the spring loaded holding jaws by a swinging bar. Interchangeable tooling, easily changed over, allows for the broaching of several different parts.

This machine is another example of how American can help you obtain high production with low unit cost. If you have a metal-removing problem, just send a part print and sample for a free estimate.

American *engineers and builds all three*—broaching machines, broaches and broaching fixtures.

Write today for free literature.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

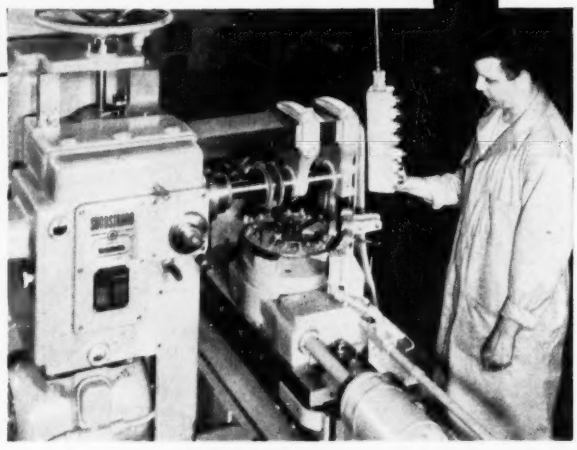
SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

For Better Milling Methods and Lower Costs . . .

Use SUNDSTRAND Machines and "Engineered Production" Service



Profitable milling production can be obtained only by lowering unit production costs . . . obtaining the most economical solution to your milling problem and the most productive milling equipment in relation to your production requirements.

Basically, there are two approaches to solving these problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, if necessary. This latter method is Sundstrand "Engineered Production" . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet all or any of your production milling requirements in small and medium size work.

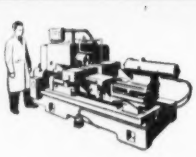
These actual examples are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.

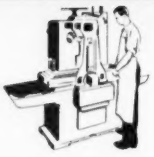
1 Milling Lugs on Clutch Plates With Standard Rigidmil

This is a Standard Sundstrand Model 22 Rigidmil equipped with a Sundstrand three station automatic index base. Three lugs on clutch plates ranging from 7″ to 12″ in diameter, are straddle milled at the rate of 54 pieces per hour. The operator locates the parts by means of a swing type radial locator and clamps part ready for machining. A gang of three cutters mills the slot in the center of the lug and mills two sides. Machine cycle is automatic and operator merely loads, locates and unloads the work.

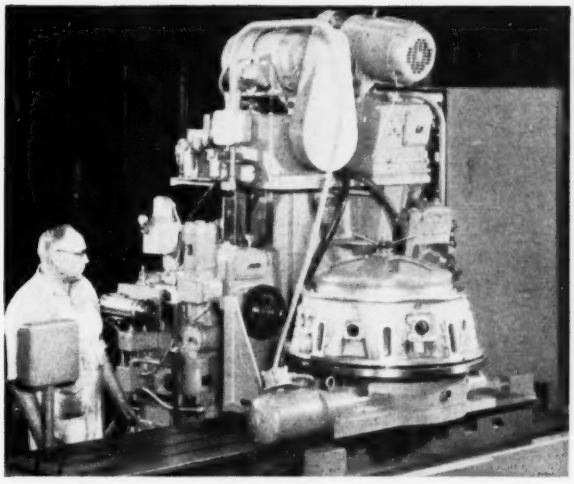
SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

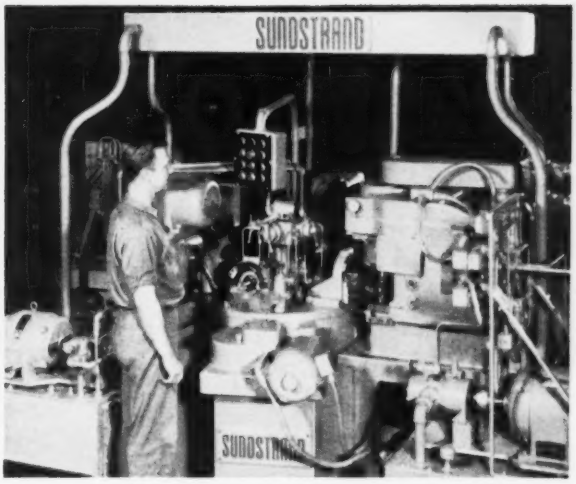


2 Milling Compressor Frames With Semi-Standard Rigidmil

This Sundstrand Model 33 Rigidmil has a single column on which a horizontal and special angular head is mounted. Angular head mills 8 angular pads on rear compressor frames and the horizontal head mills 13 other various sized pads.

Three different diameter cutters are used on the horizontal spindle, depending on size of pad to be milled. Cutters have quick change adaptors to facilitate speedy change over. Depth of cut on horizontal head is determined by setting of dogs.

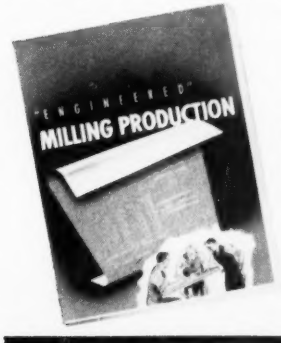
Table and head feeds are electronically controlled by operator who hand-regulates potentiometers thru a range of 2″ to 100″ per minute feed. Spindle speeds are controlled by pick-off gears. The special 30″ electric index base with 21 stations is push-button controlled.



3 Milling Piston Retainers With Special Rigidmil

Here is a Sundstrand Special Purpose Four Station Process Milling Machine for milling slots in Piston Retainers. Part is located and clamped on O.D. Operator loads and unloads fixture at Station No. 1 and pushes start button. Table indexes to the second station for milling a 7/16″ wide slot. A single spindle horizontal milling head is mounted on saddle ways. Saddle feeds up to mill and head and saddle return for index. At station No. 3 a 5/32″ wide slot is milled and table indexes to station No. 4. Unit at station No. 3 is identical to that at station No. 2. At station No. 4 a 3/16″ wide slot is milled in face of hub. This unit consists of a bedwing having horizontal ways with a vertical spindle milling head.

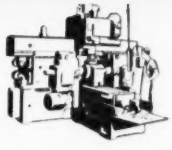
All milling units are interlocked with the index table for automatic operation. Production is 180 pieces per hour.

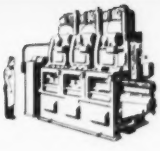


FREE DATA

You'll find plenty of milling methods in this book . . . methods that may provide a short cut or profitable solution to similar jobs in your shop now. Tooling diagrams and machine designs are both included. Write for your copy today. Ask for Bulletin No. 641.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





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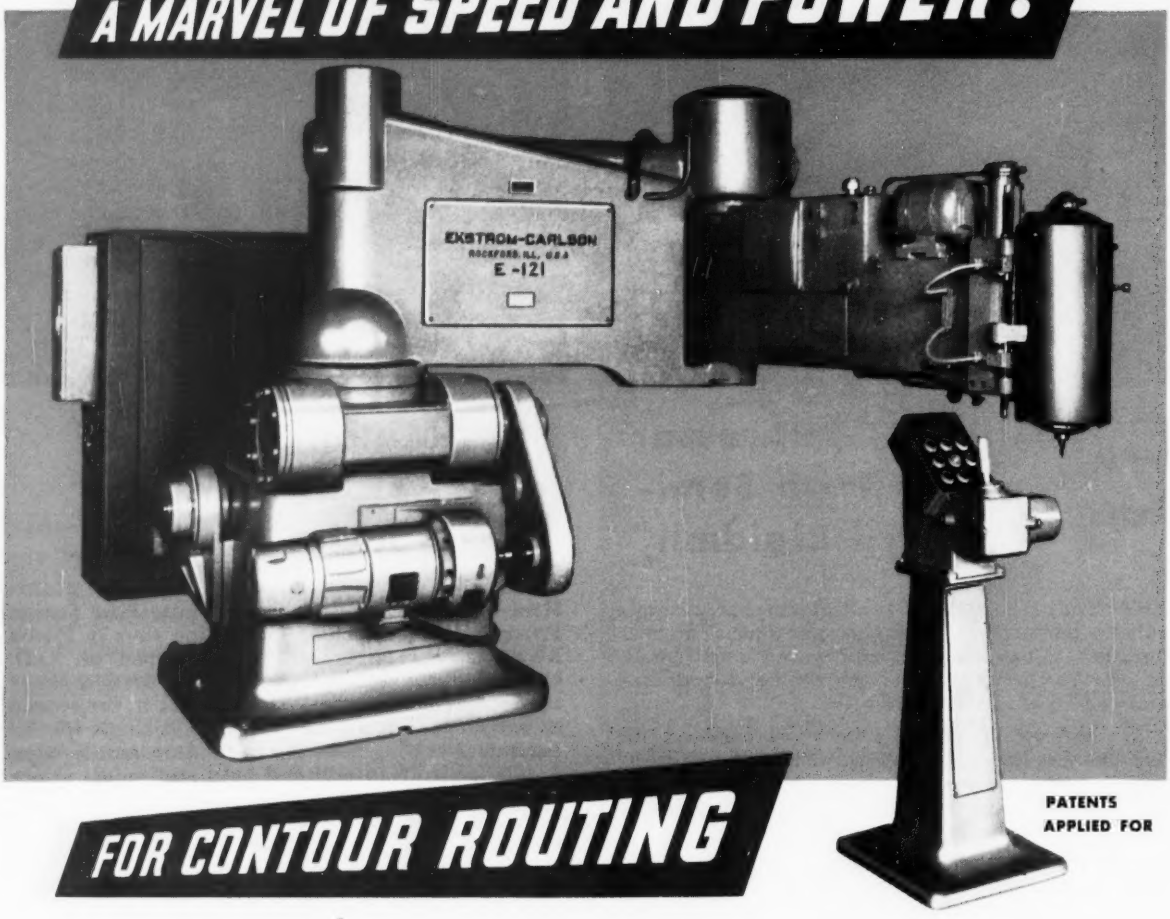
A MARVEL OF SPEED AND POWER!



FOR CONTOUR ROUTING

PATENTS APPLIED FOR

EKSTROM, CARLSON E-121 ELECTRIC

Contour Routing and Milling Machine

Here is the newest, most advanced machine for contour routing and milling of aluminum slabs or stacks of sheets up to 2″ thick — easier and faster than it has ever been done before! The EKSTROM, CARLSON E-121 shown above is an all-electric machine with a simple joy-stick controlling both direction and rate of feed. Now, with a minimum of effort, an easily-trained operator, working at a remote control station, can follow complex templates, do inside or outside routing, control depth of cut accurately, change over quickly from one job to another, break production records, and reduce costs. Write *today* for literature giving complete details.

EKSTROM, CARLSON & CO.
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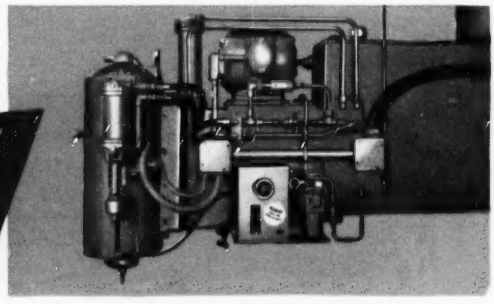
Rockford, Ill.



by EKSTROM, CARLSON

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Where finish and Accurate Size are of Prime Importance...

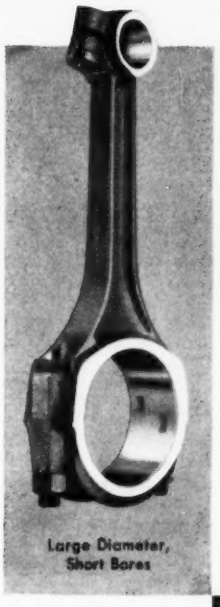
ANY BORE

OPEN END • BLIND END • PORTED • SLOTTED

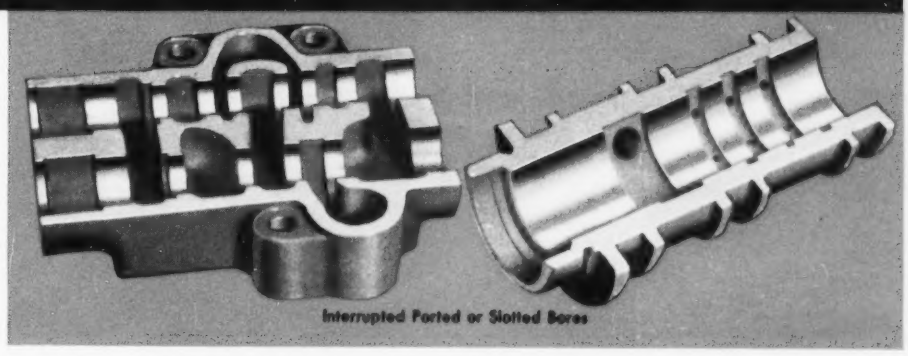
CAN BE HONED WITH

BARNESDRIL

HONING EQUIPMENT!

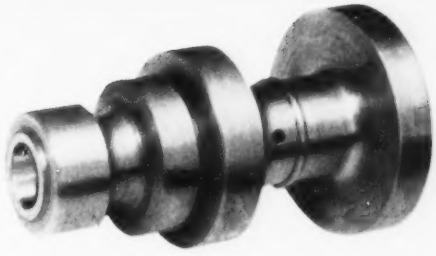


Large Diameter, Short Bores

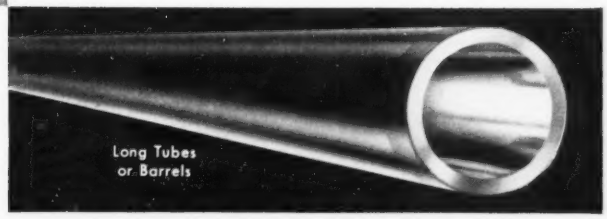


Interrupted Ported or Slotted Bores

Send us specifications, tolerances and production requirements on any Hole Finishing Job. BARNESDRIL Engineers will send you equipment recommendations and production analysis without cost or obligation.



Small Diameter, Long Bores



Long Tubes or Barrels

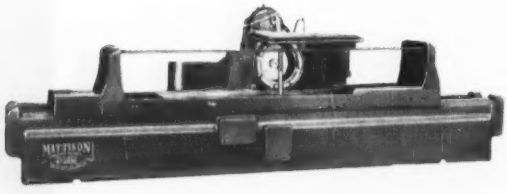
HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Grinding matching surfaces of connecting rods on Mattison 4000 Face Grinder at Caterpillar Tractor Co.



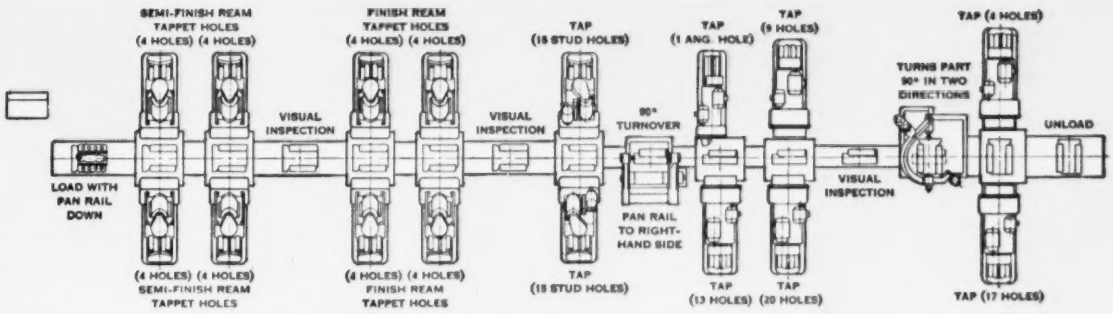
Matching surfaces of connecting rods are accurately ground on a high productive basis on the Mattison No. 4000 Face Grinder. A special hydraulically operated fixture holds rod and cap in position.

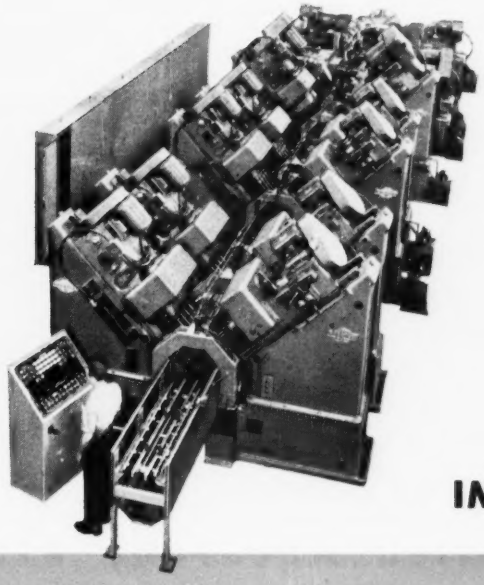
Mattison Face Grinders will handle a wide range of work and are profitably used in virtually all industries — metal working, railroad shops, paper and pulp mills, terra cotta and rubber plants, steel mills and foundries. Ask us for free copy of bulletin 846-2RM for further information on our complete line of Face Grinders.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**


SEMI-FINISH REAM TAPPET HOLES (4 HOLES) (4 HOLES)
FINISH REAM TAPPET HOLES (4 HOLES) (4 HOLES)
TAP (15 STUD HOLES)
TAP (1 ANG. HOLE)
TAP (9 HOLES)
TAP (4 HOLES)
TURNS PART 90° IN TWO DIRECTIONS
UNLOAD
VISUAL INSPECTION
VISUAL INSPECTION
90° TURNOVER
VISUAL INSPECTION
LOAD WITH PAN RAIL DOWN
PAN RAIL TO RIGHT-HAND SIDE
(4 HOLES) (4 HOLES) SEMI-FINISH REAM TAPPET HOLES
(4 HOLES) (4 HOLES) FINISH REAM TAPPET HOLES
TAP (15 STUD HOLES)
TAP (13 HOLES)
TAP (20 HOLES)
TAP (17 HOLES)



SOME NEW IDEAS FOR MACHINING AUTOMOBILE V-8 CYLINDER BLOCKS

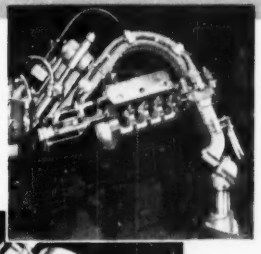
On this new automatic transfer machine — one of the latest in the long series pioneered by Greenlee — automatic handling and repositioning of the block provides some new accomplishments. Two repositioning stations permit the units of the machine to work on the block from *six* different directions. Instead of being slid along the rails, the work is *lifted and carried* between positive locating fixtures at each position.

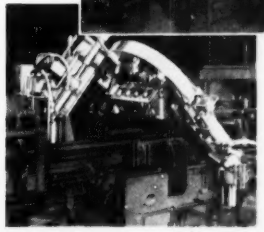
UNIQUE ELEMENTS IMPROVE PERFORMANCE OF

GREENLEE

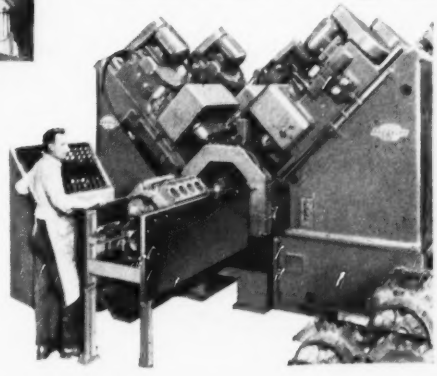
TRANSFER MACHINE

The unusual repositioning unit shown at the left, plus a number of other distinctive Greenlee features, enable the user of this machine to achieve new high standards of quality and production.





Above, two views of the "half-twist" repositioning unit which relocates the block 90° *in two directions simultaneously*, rolling it half over and also turning it from endways to crossways of the machine.



Left, the "front" end of the machine where the partly-finished block is easily rolled into proper position for the transfer bar to lift and carry it automatically into the first machining unit, where it is positively located and clamped for the tool-feed cycle.

GREENLEE

GREENLEE BROS. & CO.
1863 MASON AVENUE
ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

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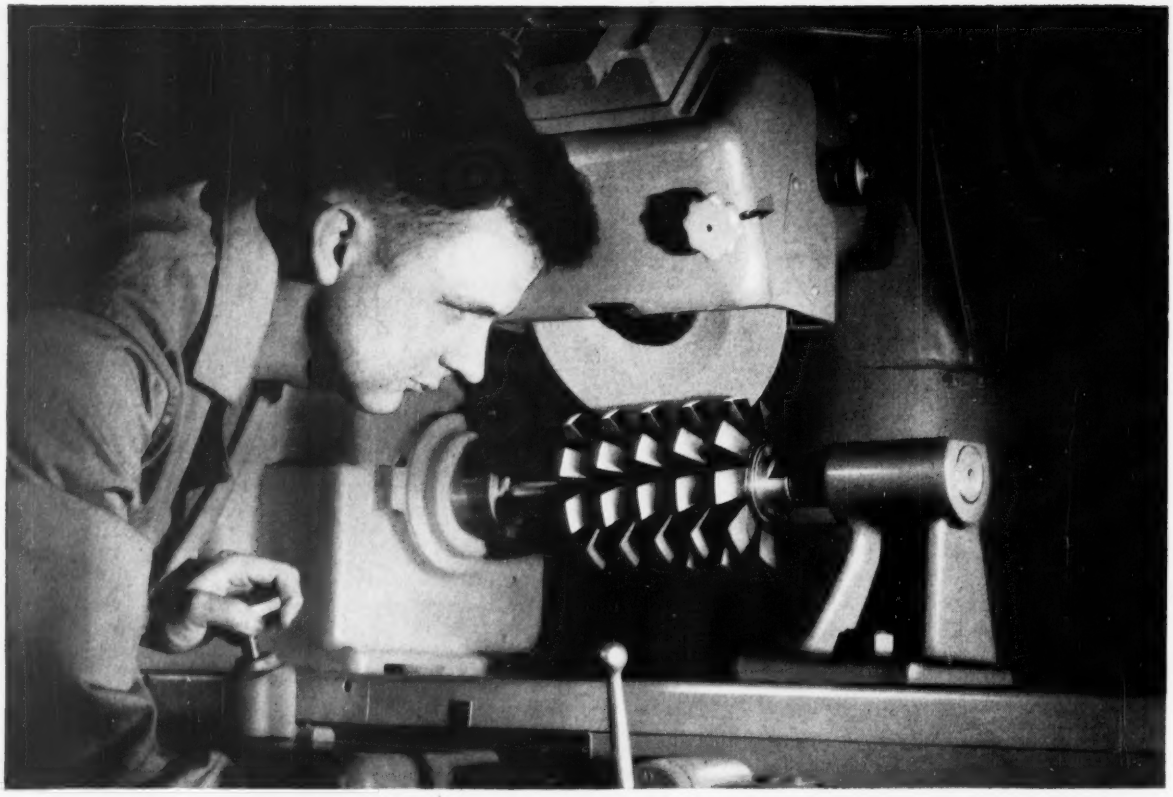
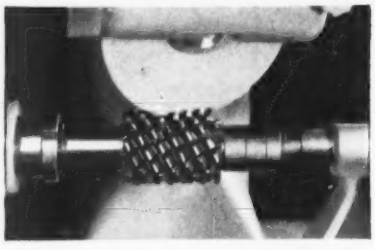
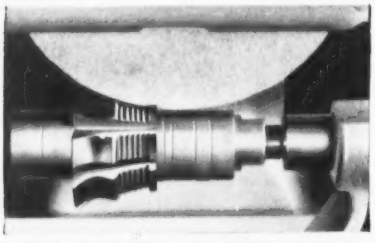
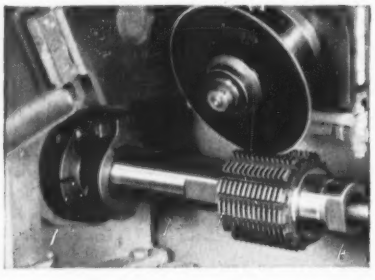








Controlled Accuracy with Automatic Sharpening

For Hobs and Formed Cutters

For the finest in tool accuracy, correct sharpening is essential. The accuracy for which you pay in hobs, cutters, machines, blanks, tooling and labor — is lost immediately when hobs and formed cutters are improperly sharpened.

Without precision control of tool sharpening, lead, tooth profile and other elements may lose important accuracy originally built into the tool. This loss of accuracy produces faulty pieces, rejects, reworks, increased inspection time and lost machine productive time.

Barber-Colman cutting tool experts have developed automatic Hob and Formed Cutter Sharpening Machines in a range that will suit almost every sharpening need for this type of tool. These machines provide means for sharpening hobs and formed cutters to their original tolerances.

B U I L D E R S O F P R E C I S I O N G E A R

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

dry or wet grinding

Wet grinding can be provided on these machines to handle various kinds of sharpening required on production cutting tools. Basic design of the machines includes protection and sealing of all vital parts against any adverse effects of oil or water coolants. Equipment for wet grinding includes coolant tank, pump and splash guards.

wide range of work

Any tool with equally spaced cutting teeth which requires sharpening across the face of the teeth can be sharpened automatically on Barber-Colman machines. This includes small diameter hobs, hobs 10" diameter up to 1½ pitch, carbide-tipped tools, straight or helical flutes, thread milling cutters and shank type tools.

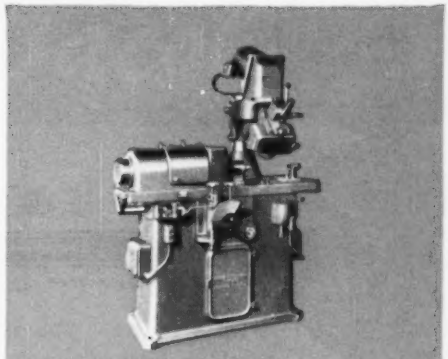
adaptable for all sizes of shops

Barber-Colman Sharpening Machines range from a moderate cost, basic machine for sharpening a great variety of small or medium size work, up to machines equipped with hydraulic table speed and stroke for large heavy work and production runs. Special equipment for sharpening tapered, special helix or carbide-tipped tools is available. All machines are automatically operated for stroke, index and feed. Each is equipped with a precision built-in wheel dresser.

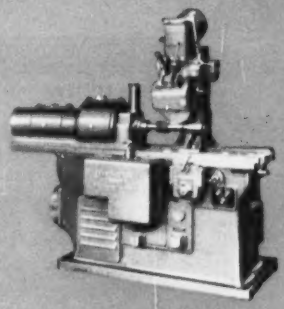
For maximum cutting efficiency, sharpen your hobs and formed cutters with controlled accuracy — AUTOMATICALLY. Call your Barber-Colman representative and discuss your sharpening problems with him.

SEND FOR COPIES

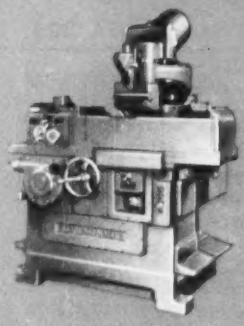
. . . of these Automatic Sharpening Machine Bulletins. You will find information on the machine which best suits your work.



No. 4-4 AUTOMATIC SHARPENING MACHINE



No. 10-12 AUTOMATIC SHARPENING MACHINE



No. 6-5 AUTOMATIC SHARPENING MACHINE

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HOBBING MACHINES
HOB SHARPENING MACHINES

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GENERAL OFFICES AND PLANT, 623 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911

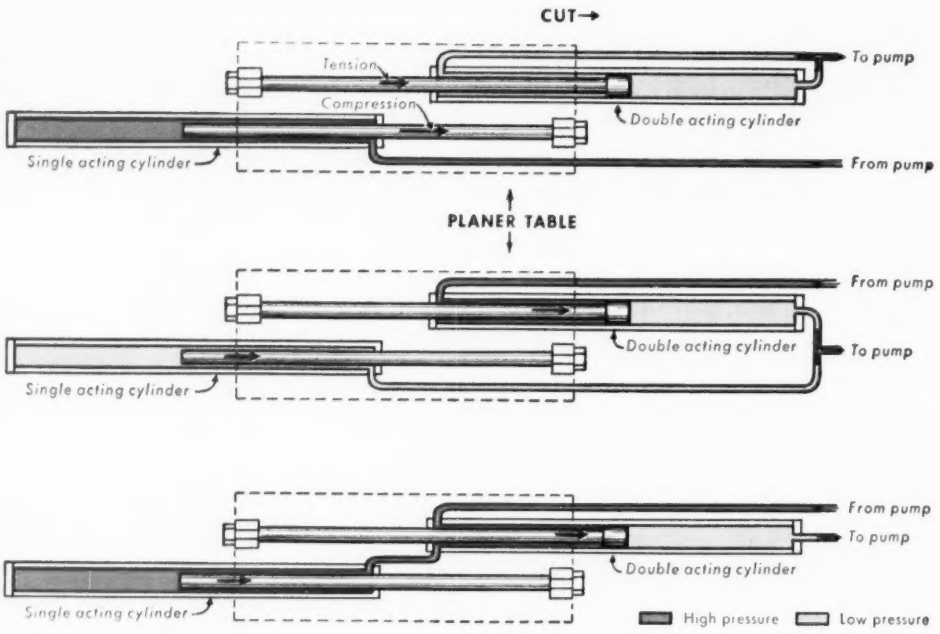
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

the triple circuit

high speed
LOW CUTTING FORCE

medium speed
MEDIUM CUTTING FORCE

low speed
HEAVY CUTTING FORCE



Infinite Speeds from 10 to 300 fpm. stepped through 3 distinct cutting force ranges.

Pendant control of range and cutting speed selection.

Maximum return speed regardless of cutting speed.

Quick reversals with minimum overtravel.

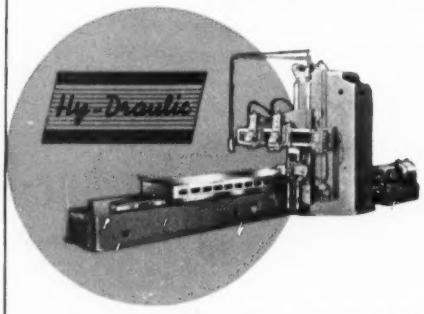
Suitable for prolonged use on short stroke work, as well as long work.

Hydraulic drive and feed has long provided efficiency and ease in the planing and shaping of metal.

Now a singular new dimension has been added to the proven efficiency and economy of Hydraulic planing. The new Triple Circuit provides the correct combination of cutting speed and required force, to most economically machine materials from the free cutting types to the toughest steel.

Many plants, large and small, who are evaluating their present equipment will find the Triple Circuit a significant development in their plans for plant modernization.

Get full details on this new Hy-Draulic achievement from any Rockfod Machine Tool Co. Representative, or write directly to us.



ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

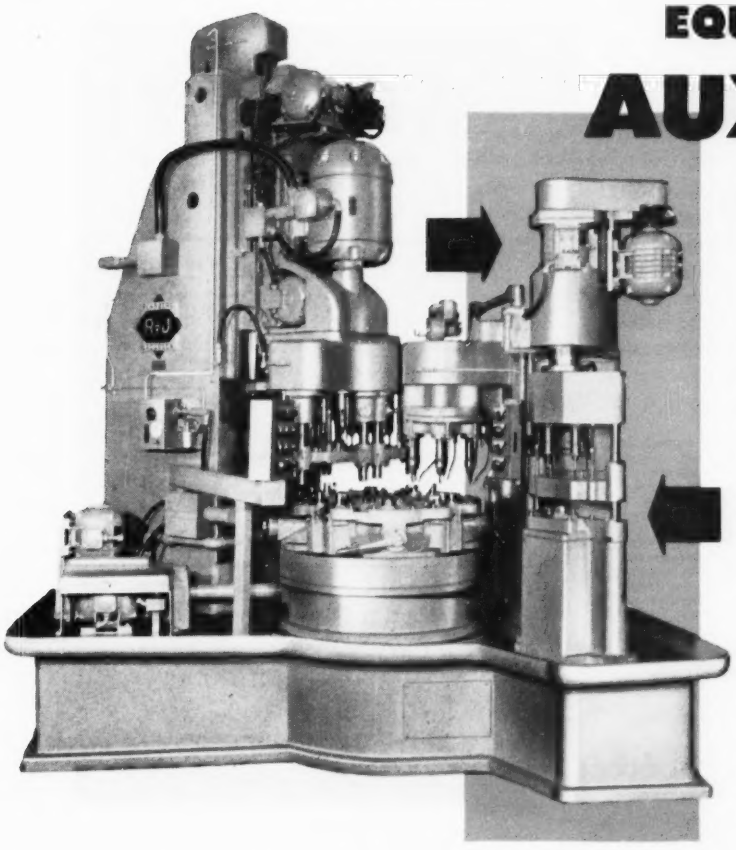
Rehnberg-Jacobson

This four-station vertical automatic-index machine performs a series of operations on cast iron flywheels for a well-known automobile engine. Station 1 is for loading and unloading, with hand-clamped fixtures. Station 2 drills six holes for ⅜"-16 tap, and drills six .505/.509" holes. Station 3 stepreams and countersinks six holes for ⅜"-16 tap, the two diameters being .315" and .377", and reams six holes .505/.507". Station 4 taps the six ⅜"-16 holes. Rehnberg-Jacobson ALL-MECHANICAL UNITS

AUTOMOBILE FLYWHEELS

are used — a Screw Feed Unit for the multiple-spindle head on Stations 2 and 3, and a six-spindle individual lead screw tapping head for Station 4.

DRILLING, REAMING, and TAPPING MACHINE



EQUIPPED WITH AUXILIARY UNIT

FOR SECOND OPERATION

When the operator takes the piece out of the index unit fixture, he *turns it over* and places it on locating pins in the auxiliary unit mounted at the right-hand side of the machine bed. (This unit is indicated by arrows in the illustration.) When started by a separate control button, this auxiliary unit drills two .3437" holes ½" deep. An R-J Self-Contained ALL-MECHANICAL No. 4 Drill Unit provides the power and feed for these drills. The cycle time of the auxiliary unit is 8 seconds, of the main part of the machine 16 seconds. Rated capacity is 225 pieces per hour.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

GREENLEE *Automatics*

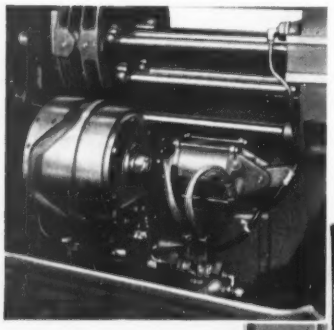
Close-up of the rear stock reel support, showing a piston (which follows and pushes the stock) being inserted in a stock tube. The air hoses are equipped with speed couplers.

AIR-FEED

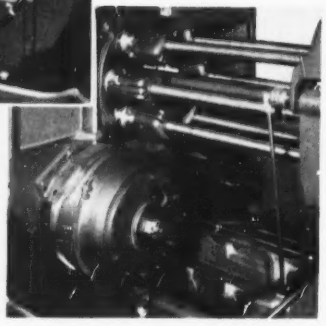
(PNEUMATIC STOCK FEED)

This method of feeding out stock was developed primarily for the many screw machine jobs that require either multiple feed-out arrangements, greater feed-out length than the conventional mechanical arrangement will permit, or for machining parts made from ground stock where pusher marks would be objectionable. It can be adapted to all 1" and 1⅝" GREENLEE Automatics.

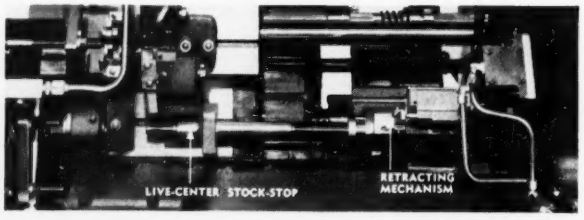
- FEEDS OUT STOCK TO 16½"
- PROVIDES MULTIPLE FEED-OUT
- ELIMINATES STOCK SCORING
- REDUCES STOCK REEL NOISE
- ELIMINATES STOCK PUSHERS
- ELIMINATES FEED-OUT CAMS



Left: One method of opening and closing the collets for multiple feed-out. The air cylinder, controlled by a plate cam on the cam drum, actuates the collet-operating rings. Various arrangements can be made, depending on the requirements of the particular job being set up.



Right: Simplification of the feed cam drum possible with air feed, where the collets are to be opened by the conventional mechanical arrangement between the 6th and 1st positions. Feed-out is usually against a standard fixed stop stock in such cases.



Above: A method used for feeding out stock during the machining cycle. The stock is fed out against an adjustable live-center stock-stop arrangement. When the collet jaws are closed, the live-center retracts and permits the stock to rotate freely and index to the next position.

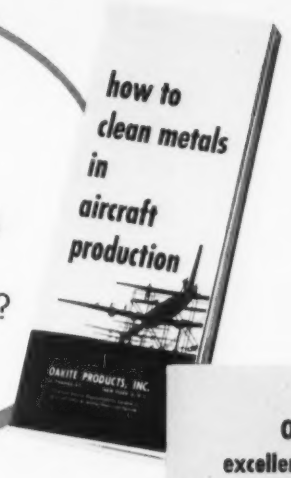
Write for Free Literature

GREENLEE

GREENLEE BROS. & CO., 1863 MASON AVE., ROCKFORD, ILL.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

WHAT IS YOUR TOUGHEST CLEANING JOB IN AIRCRAFT PRODUCTION?



¶ **That's** hard to answer, isn't it? Maybe it's hard to remove smut from one alloy; no problem with other alloys. One drawing compound may harden into all kinds of trouble; others may wash away in a wink. ¶ **But,** whether it's an oxide or a weld flux or a stencil mark or a synthetic enamel that gives you a headache today, your Oakite Technical Service Representative is pretty sure to be able to help you laugh it off tomorrow. ¶ **Several** of our customers helped us make a list of jobs on which we could give them the most help. The table at the right shows these jobs in order of volume rather than toughness. There is some overlapping in the listings and some of the jobs – like machining, grinding, forming and preventing corrosion – are not strictly cleaning jobs. But every one is a job for which we have a material or a method that may be worth a lot of money to you. ¶ **You** may not agree with the ranking of these jobs. But a glance at the list may stimulate your ideas about improving some of your operations. If you'll circle in the coupon the numbers of the jobs that interest you, we'll be glad to tell you about Oakite materials designed for your work.

FREE Our 48-page illustrated booklet *"How to Clean Metals in Aircraft Production"* contains information on all the cleaning jobs in the list.

Oakite has excellent materials for all these jobs:

1. Cleaning aluminum
2. Stripping paint with solvent strippers
3. Stripping paint from steel (hot tank)
4. Machining and grinding
5. Deoxidizing aluminum
6. Steam cleaning aluminum
7. Steam cleaning steel
8. Deflocculating paint in spray booths
9. Metal forming
10. Stripping paint from aluminum (hot tank)
11. Removing corrosion and preparing for painting
12. Descaling
13. Preventing corrosion
14. Cleaning magnesium
15. Electrocleaning steel
16. Barrel finishing
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Send me a FREE copy of your booklet *"How to Clean Metals in Aircraft Production."*
I especially wish to obtain better results in the jobs indicated by the numbers circled below:

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10 11 12 13 14 15 16 17

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SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

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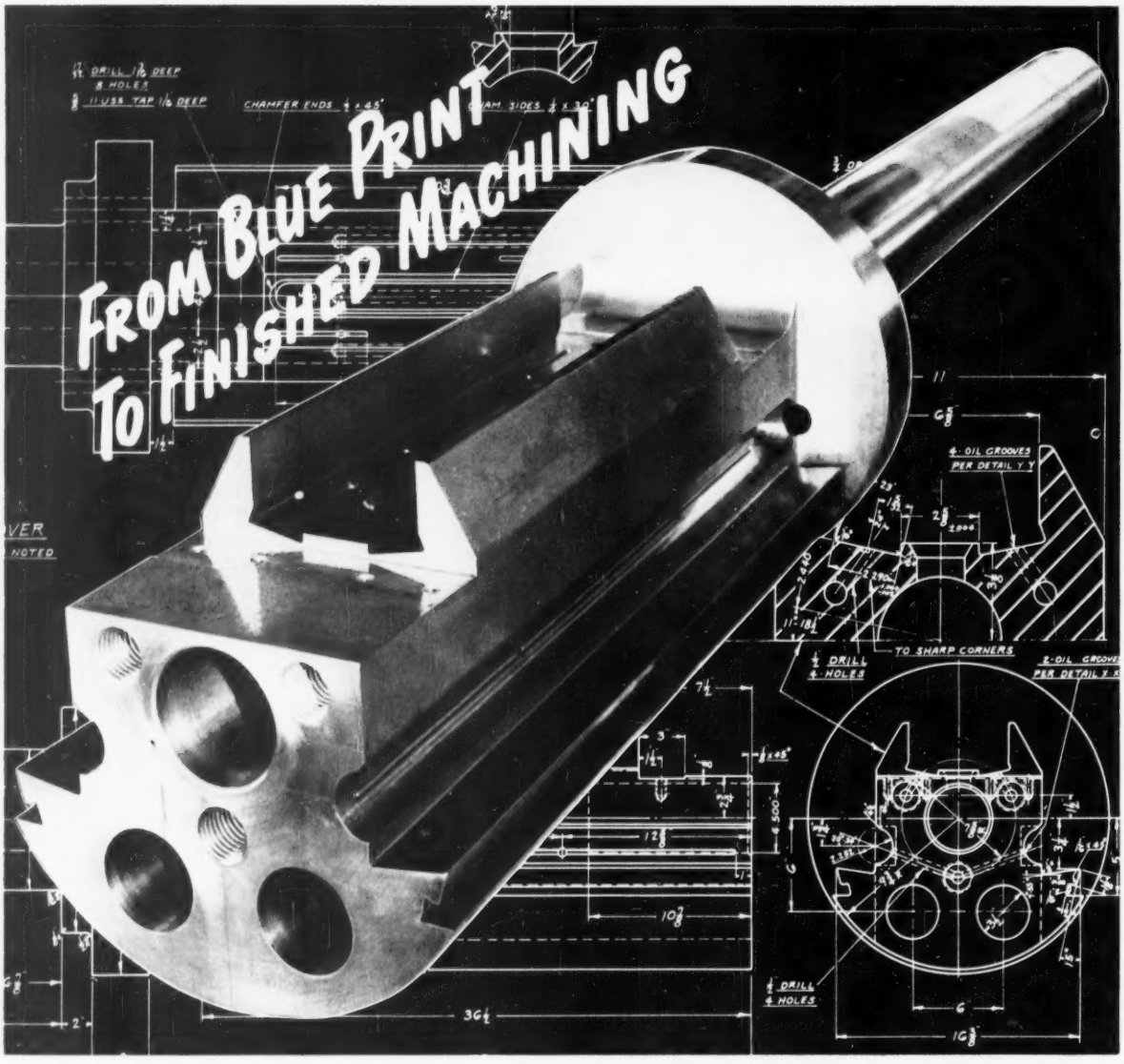

This Block Body for a Tension Reel represents the coordinated effort of many National Forge skills in turning out the required electric alloy steel, the proper heat treating and the intricate machining to exacting tolerances.

National Forge offers you complete forging service in one plant—under one responsibility.

Why not take advantage of this "all-in-one" service the next time you need forgings?

For full information, write NATIONAL FORGE AND ORDNANCE COMPANY, Irvine, Warren County, Pennsylvania.

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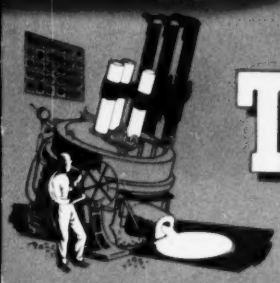


Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM TOOL STEEL ENGINEER SAYS:

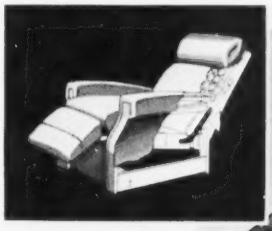
Pack-hardening Tools? It's Best to Use a Thermocouple

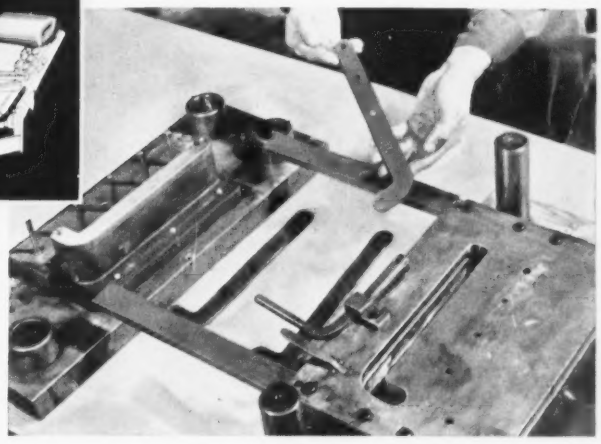
In shops which do not have controlled atmosphere furnaces, you will sometimes find it desirable to pack harden the tools, so as to avoid both excessive scaling and decarburization.

This can be accomplished by packing the tools in sealed containers prior to charging in the furnace, using protective materials such as cast iron chips, wood charcoal, or spent carburizing compound. However, in following this procedure, this precaution is important: do not permit any of the tools to come in contact with the container.

Heating through the pack is a slow process at best, and for this reason it is often difficult to make a close estimate of the length of time required for proper heating. We therefore recommend that a thermocouple be inserted in the pack, close to the tools.

After the tools have been heated the proper length of time, they may be removed from the pack, then quenched in the usual manner. If a controlled atmosphere furnace is not available, pack hardening should always be used on those steels which have a quenching temperature in excess of 1650 F. This does not hold true, however, in the case of high-speed and hot work steels.





Inset (above) shows legs of chair in which back brace is used. The BTR disc, together with the chair, is shown at right.

BTR BLANKING DIE MAKES PART FOR MECHANISM OF BARCALOUNGER CHAIR

At the busy plant of Barcalo Manufacturing Co., Buffalo, N. Y., they're turning out, among other things, a back hinge which is used in the tilting mechanism of the popular Barcalounger chair.

The operation, performed by a blanking die in a 200-ton press, involves two steps—punching five small diameter holes in 3/16-in. sheet steel, then blanking the hinge to size. The die, made of BTR, is hardened to Rockwell C58-60. It is giving a good account of itself because of its resistance to the shock encountered. And as for wear, the die is expected to last and last, for with 6000 pieces produced daily, its use is required only periodically.

BTR (Bethlehem Tool Room) is our manganese chromium tungsten grade of oil hardening tool steel, well known for its safe-hardening property.

Typical Analysis:

Carbon	0.90	Vanadium	0.20
Manganese	1.20	Tungsten	0.50
Chromium	0.50		

If you have a job calling for a safer hardening steel than carbon tool steel for such applications, say, as blanking, cold forming, and bending dies, forming rolls and the like — it's hard to beat BTR.

Lehigh S Increases Life of Burnishing Rolls

This picture shows the burnishing of a freight car axle to provide a smooth, mirror finish. Two rolls, at right angles to the work and applied with about 100 psi pressure, cold roll the axle simultaneously. The rolls are made of Lehigh S (our oil hardening type of high carbon, high chromium tool steel), hardened to Rockwell C-62. They burnish 60 axles in 8 hours, and have a service life of about six months. With grades formerly used, the maximum service life was two months.

STANDARD CARBOLOY® TOOLS

CEMENTED CARBIDE

reduce inventory, increase output, cut production costs on single-point tool jobs

Standard Carboloy Tools are effectively replacing "specials" in all sizes and types of shops. Comparison records prove "Standards" consistently produce results like these: Machining costs reduced 25%; machine output increased 42%; roughing and finishing time cut 60%; inventories cut up to 40%.

JUST ELEVEN Standard Carboloy Tools – styles A to G – will do up to 80% of all single-point tool jobs . . . outlast steel tools by as much as 10 to 1. Use them "as is" for turning, facing, boring . . . or adapt them quickly to your own "specials."

By using "Standards" you'll eliminate hundreds of costly, inventory-loading special tools. You'll slash downtime to an absolute minimum. Your local Authorized Carboloy Distributor can always give you immediate delivery on all Standard Tools and blanks, insert blanks and boring tools.

Standard Carboloy Tools are available to handle every single-point tool job. Send coupon, today, for free technical literature.

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

CARBOLOY
Department of General Electric Company
11147 E. 8 Mile Road, Detroit 32, Michigan

Send me the following, without cost or obligation:

- ☐ Application data on Grade 370
- ☐ "Brief-A-Log" Condensed Catalog and Price List, GT-265, with "Standard" specifications.
- ☐ Have a tool expert call to show us how to use "Standards" effectively.

Name _____ Position _____

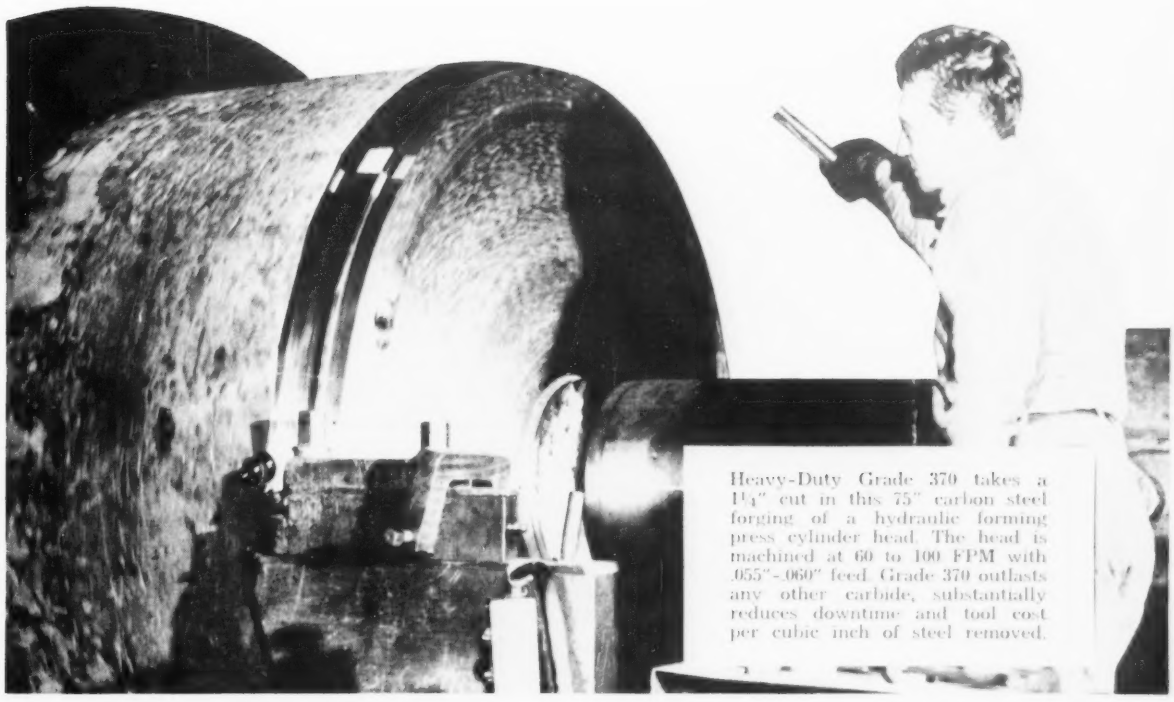
Company _____

Address _____

City _____ Zone _____ State _____

NEW CARBOLOY® GRADE 370
CEMENTED CARBIDE

cuts more cubic inches of steel per minute—with longer tool life—than any other carbide



Heavy-Duty Grade 370 takes a 1¼" cut in this 75" carbon steel forging of a hydraulic forming press cylinder head. The head is machined at 60 to 100 FPM with .055"-.060" feed. Grade 370 outlasts any other carbide, substantially reduces downtime and tool cost per cubic inch of steel removed.

NEW Heavy-Duty Grade 370 Carboloy cemented carbide was specially developed for taking heavier cuts in steel, at higher speeds than ever before practical. Grade 370 cuts more cubic inches of steel per minute – with longer tool life – than *any* existing carbide.

Other carbides fail when machining at higher speeds because the tremendous temperatures and pressures deform their cutting edges. Heavy-Duty Grade 370, manufactured by an entirely new process, has a built-in rigidity to resist this deformation, even at temperatures of around 1800 F.

Carboloy Grade 370 is being used successfully on such tough, heavy-duty applications as rolls, gun barrels and locomotive wheels. Grade 370 lasts longer than any other carbide – *increases production by as much as 30%*.

The first of the new Series 300 steel-cutting carbides, Heavy-Duty Grade 370 is available immediately in a number of sizes and shapes. Trained engineers from the Carboloy Engineering Appraisal Service will work with you on your heavy-duty cutting jobs. Send coupon, at left, for information, and for free technical literature.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

DIE CAST OF ZINC

for DE VILBISS

Here's Why .....

The unusual combination of cored openings, decorative effects and engraved lettering called for in this part were best obtained as a ZINC Die Casting. Furthermore, it is important that the part be highly corrosion-resistant and of sound structure to withstand up to 300 pounds per square inch of air pressure without a bubble of leakage. No other metal or method of fabrication could provide all of these physical characteristics at a cost comparable with ZINC Die Casting.

This casting – the regulator head for the pictured De Vilbiss air transformer, which feeds compressed air to spraying and other equipment with a high degree of uniformity and accuracy – requires an absolute minimum of secondary operations prior to assembly, thanks to the unusual castability of ZINC. And the as-cast surfaces of this casting are plated easily and economically.

The De Vilbiss air transformer is just one of countless products made better with ZINC die castings. Ask us – or any die casting company – for a copy of our booklet "The End Uses of Zinc Die Castings" which has 48 pages of successful ZINC die casting applications.

ZINC IS FREELY AVAILABLE

The American Zinc Institute has issued a new folder which gives the facts on why "zinc supplies will continue to be sufficient to meet both near and long range requirements". Ask us for a copy.

The New Jersey Zinc Company
160 Front St., New York 38, N. Y.

ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

For more information on products advertised, use Inquiry Card, page 247

Switch to Graph-Mo steel for spacing collars ends thread damage, eliminates thread grinding

NEAR perfect accuracy is the number 1 requirement of the Dayton Rogers Manufacturing Company, Minneapolis, for its micrometer adjustable spacing collars for milling machine cutter arbors. But when machine operators tightened the collars, they often exerted excessive arbor nut pressure that ruined accuracy and destroyed micrometer threads.

Then Dayton Rogers switched to Graph-Mo*, one of four Timken* graphitic tool steels. They found that Graph-Mo collars can take 20 tons pressure on both sides without disturbing accuracy or damaging threads. It's almost impossible for an operator to exert excessive milling machine arbor nut pressure. Micrometer accuracy is assured for the life of the spacing collars.

What's more, they discovered that the threads maintain their accuracy after heat treating. No thread grinding is necessary. Now Dayton Rogers uses Graph-Mo on all six collar sizes, from ⅜" to 1".

Users also report that Graph-Mo steel machines 30% faster, outwears other tool steels 3 to 1. It has a minimum tendency to pick up, scuff or gall. Responds uniformly to heat treatment.

For dollar-saving information on the use of Graph-Mo and other Timken graphitic tool steels for machine parts, dies, punches and gages, write for the new "Timken Graphitic Steel Data Book" just out. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

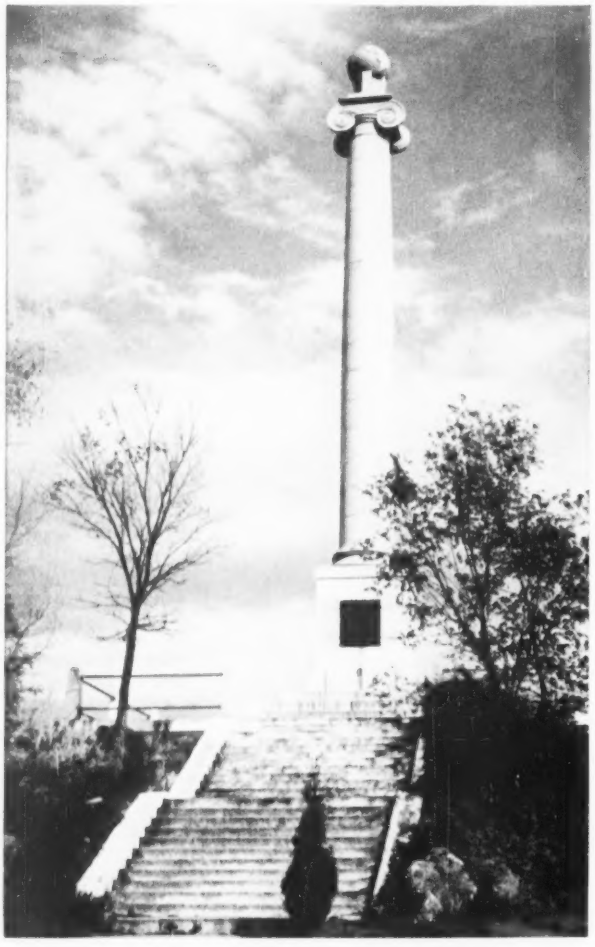
YEARS AHEAD — THROUGH EXPERIENCE AND RESEARCH

TIMKEN
Fine Alloy
STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

CUMBERLAND GROUND BARS

We manufacture 8" diameter, 7-1/2", 7", 6-1/2", 6", and also odd and intermediate sizes down to and including 1-1/8".

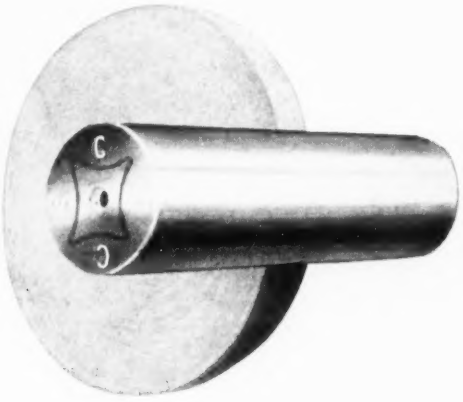


ON THE WEST VIRGINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was shown the Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of secrecy—."

At a later date GEORGE WASHINGTON said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to filing or fitting.

IMMEDIATE BARS

DISTRIBUTED BY

Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkridge Brothers Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, N. Y.—Jos. T. Ryerson & Son, Inc.
Cambridge, Mass.—Brown-Wales Company
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Montreal, Canada—Drummond McCall & Co., Ltd.
New Orleans, La.—R. J. Tricon Co.
New York City, N. Y.—Bright Steel Corp.
Oakland, Calif.—Link-Belt Co., Pacific Div.
Philadelphia, Pa.—Charles Bond Company
Philadelphia, Pa.—Horace T. Potts Co.
Pittsburgh, Pa.—McKee Oliver, Inc.
Portland, Maine—W. L. Blake & Company
Portland, Oregon—Link-Belt Co., Pacific Div.
Providence, R. I.—Congdon & Carpenter Co.
San Francisco, Calif.—Link-Belt Co., Pacific Div.
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Spokane, Wash.—Link-Belt Co., Pacific Div.
Toronto, Canada—Drummond, McCall & Co., Ltd.
Worcester, Mass.—Pratt & Inman

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892

For more information on products advertised, use Inquiry Card, page 247

1 5/8 - 12 N-3
O.D. - 1.625 - 1.614
P.D. - 1.5709 - 1.5664
DRILL 1/2" - 4 HOLES 90° APART
Fy SQ WITH THD
Fy ALL "O" RING GROOVE SURFACES
Fy SEAT
STAMP PART No. 611 4416
MILL 6 FLATS 60° APART .03-.05 DEEP (FLATS REQUIRED)
611.4416
VALVE
TESTER

intricately machined MAX-EL alloy steel part shows minimum distortion after heat treatment...

Halliburton Oil Well Cementing Company, Duncan, Oklahoma, selected hot rolled MAX-EL 3½ bar stock for the valve shown. It's an important part of their 5⅞" tester, used to sample fluids or gases during drilling operations, sometimes 15,000 to 20,000 feet below the surface.

The valve is machined in the annealed condition and then heat-treated. Even though it varies considerably in thickness, no distortion problems are encountered in this MAX-EL part.

Try MAX-EL in your shop. You'll like its better machinability, freedom from distortion and over-all quality. And you'll get longer tool life . . . more pieces per grind. Call Crucible for immediate warehouse delivery of MAX-EL steels.

Join your Civil Defense Team NOW!

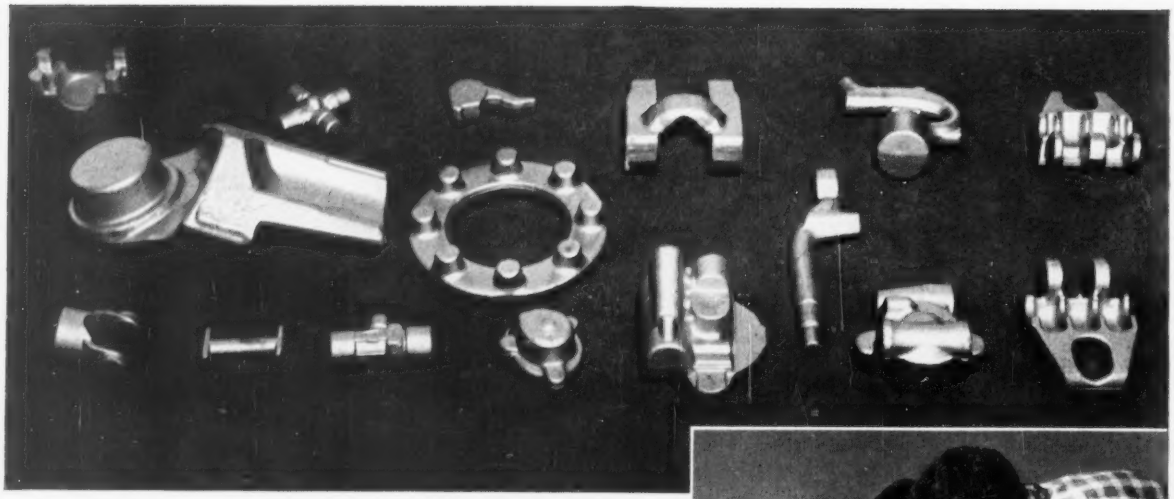
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DAYTON DENVER • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH PROVIDENCE • ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • ST. PAUL • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

For more information on products advertised, use Inquiry Card, page 247



We can make your design, too

Here are seventeen drop forgings selected at random from the millions Bethlehem has made. As you can see, they vary widely in size and design. A few of them can easily be balanced on a fingertip. In contrast, the big one has to be lifted by two strong men or mechanical hoisting equipment.

No matter how different your own design may be, there's an excellent chance that we can make it for you. Bethlehem forgings are used by customers in the oil, mining, aviation, automotive, electrical, and many other industries. Through the years, many of these customers have called upon us for some pretty special service. We think they would tell you that we have done a good job for them. We can do the same for you.

Our people will welcome your inquiries. Phone or write us if anything you build requires closed-die forgings.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Complete integration helps us maintain close controls in the making of closed-die forgings. We offer a full range of equipment, including:

Modern die-sinking shops

Steam and board drop hammers (1500 to 8000 lb)

Mechanical presses to 3000 tons

Upsetters to 9 in.

Heat-treating equipment

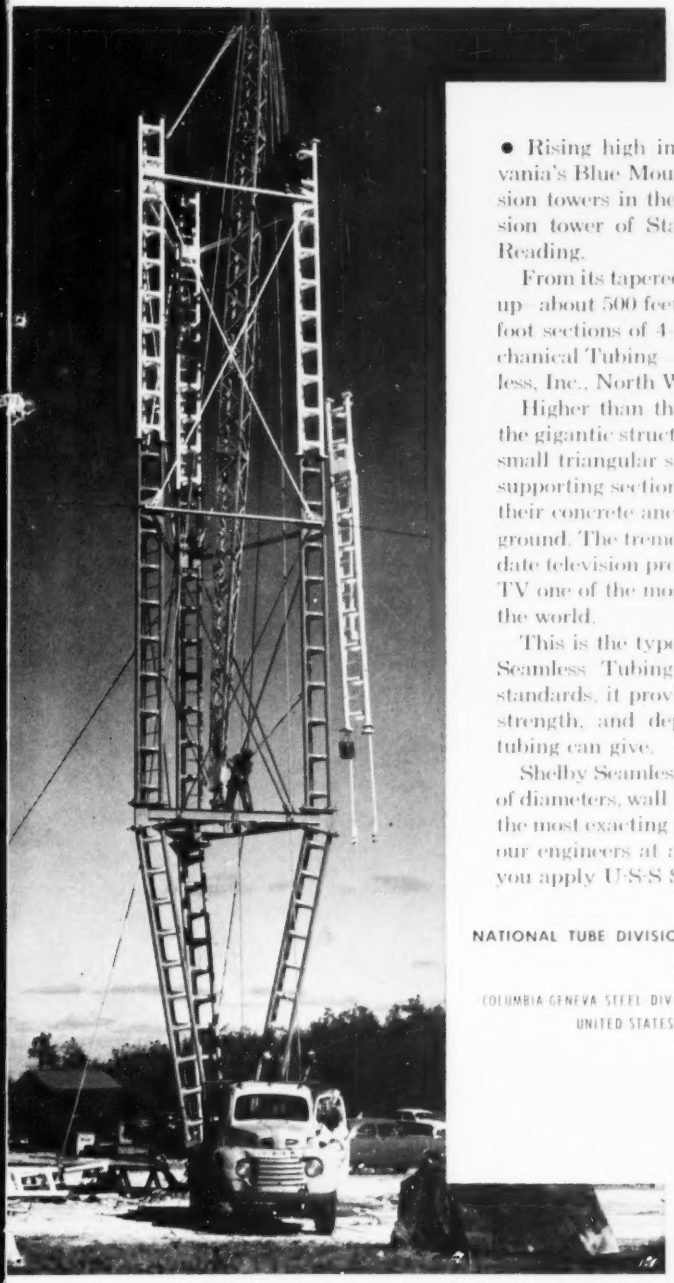
Cleaning and inspection service

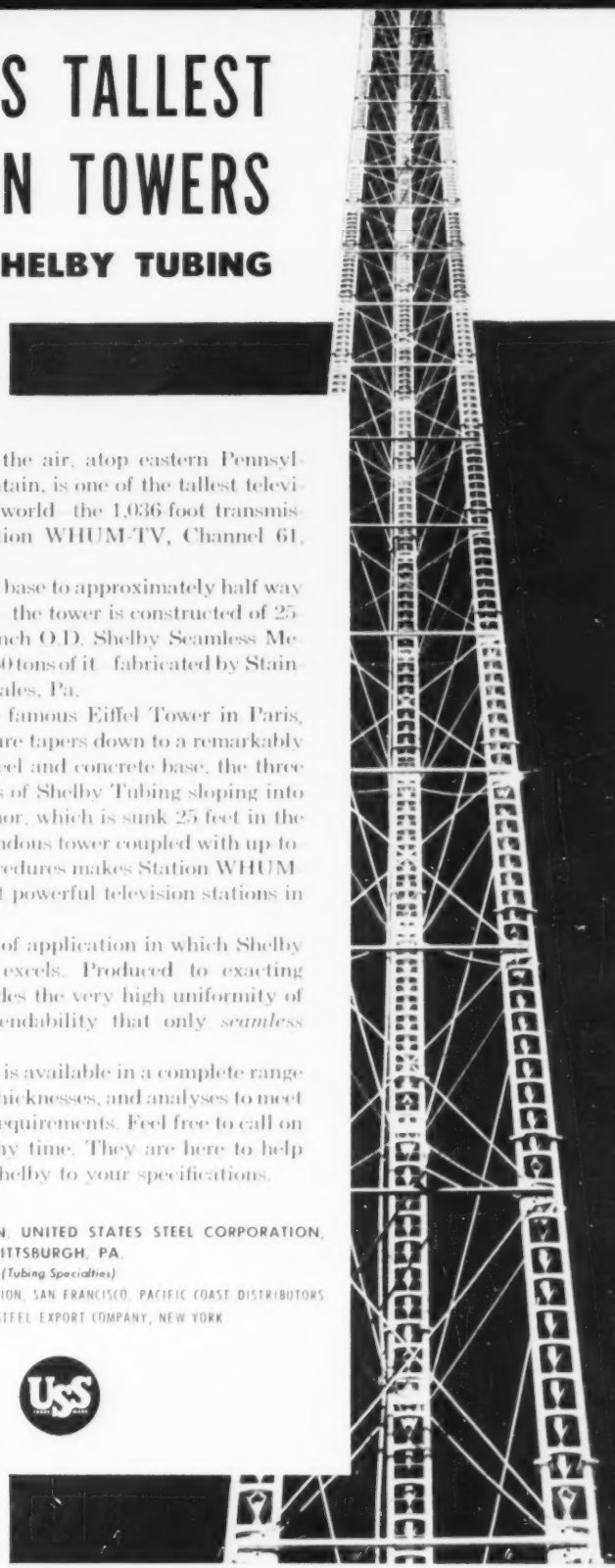
BETHLEHEM STEEL

BETHLEHEM DROP FORGINGS

ONE OF THE WORLD'S TALLEST TELEVISION TOWERS

RESTS ON 50 TONS OF SHELBY TUBING





• Rising high in the air, atop eastern Pennsylvania's Blue Mountain, is one of the tallest television towers in the world—the 1,036-foot transmission tower of Station WHUM-TV, Channel 61, Reading.

From its tapered base to approximately half way up—about 500 feet—the tower is constructed of 25-foot sections of 4-inch O.D. Shelby Seamless Mechanical Tubing—50 tons of it—fabricated by Stainless, Inc., North Wales, Pa.

Higher than the famous Eiffel Tower in Paris, the gigantic structure tapers down to a remarkably small triangular steel and concrete base, the three supporting sections of Shelby Tubing sloping into their concrete anchor, which is sunk 25 feet in the ground. The tremendous tower coupled with up-to-date television procedures makes Station WHUM-TV one of the most powerful television stations in the world.

This is the type of application in which Shelby Seamless Tubing excels. Produced to exacting standards, it provides the very high uniformity of strength, and dependability that only *seamless* tubing can give.

Shelby Seamless is available in a complete range of diameters, wall thicknesses, and analyses to meet the most exacting requirements. Feel free to call on our engineers at any time. They are here to help you apply U·S·S Shelby to your specifications.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

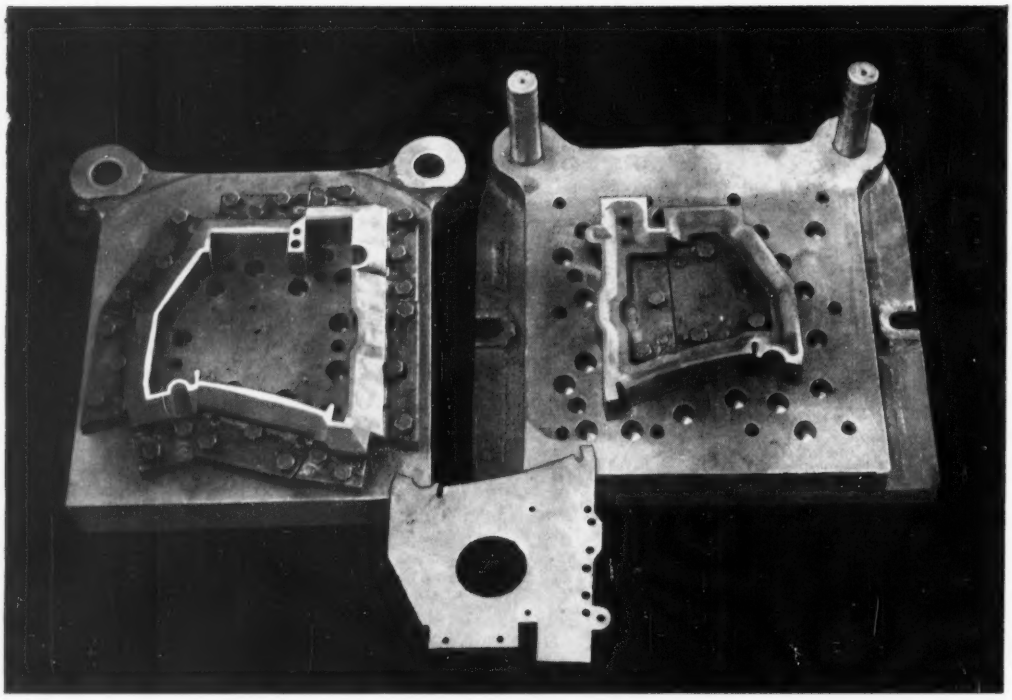
THE TOWER WAS ERECTED in 25 foot sections—each section alternately painted red and white. In an average 8-hour work day, the crew completed ten sections.

TRANSMISSION TOWER, Station WHUM-TV Reading. Steel guy wires, $1\frac{1}{4}$ inch dia., are attached to the tower at consecutive 175 foot levels, and are anchored in concrete 400 feet and 800 feet from the structure in all directions. Aircraft warning lights are also located at 175 foot levels.

WALLS WITHOUT WELDS

U·S·S SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL



How to *Cut Costs and "Corners"* on Your Blanking Dies

SEND FOR THIS NEW CATALOG
"FORGING AND CASTING PRODUCTS"

It's hot off the press with full details on FCC Air Hardening, Oil Hardening and other Cast-to-Shape Tool Steel Specialties that can save you time and money . . . also Composite Die Sections, and Smooth-Hammered Forgings in a wide range of tool and stainless steels. *Don't wait—get your copy NOW.*

Write Today
ADDRESS DEPT. M-51

You can save steel and time in the making of dies for blanking, trimming, beading, or any application involving the cutting of sheet metals to regular or irregular shapes, by assembling them from FCC Composite Steel Die Sections.

These prefabricated die parts consist of fine tool steel cutting edges, in a selection of grades, electrically welded by a special process to non-hardenable mild steel bases. Thus, screw and dowel holes may be easily drilled after heat treating, and there are numerous other advantages that will be immediately obvious to the die maker.

Thousands of die shapes may be made up from combinations of thirty-five standard sections. Specially shaped sections are manufactured to customers' specifications in five to ten days.

Make *your* dies this money-saving way. ● *Write Allegheny Ludlum Steel Corporation, Forging & Casting Division, Wanda & Jarvis Aves., Detroit 20, Mich.*

For complete **MODERN** Tooling, call
Allegheny Ludlum

AL
FINE TOOL STEELS
SINCE 1854

W & D 5075

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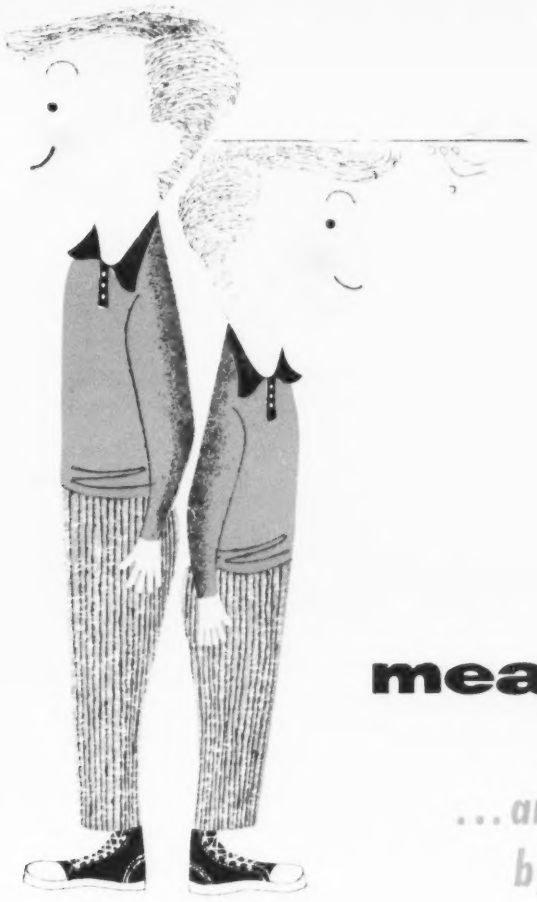


measuring up

...and REX is the standard by which all high speed steels are compared

An older brother sometimes makes a handy yardstick for measuring junior's growth. And when it comes to tool steels, REX® High Speed Steel is — and has been for over 50 years — the standard of comparison.

There's no mystery to REX High Speed Steel. Its quality has been time-tested in thousands of shops. And after all, it's performance — not claims — that really counts. Make your *own* comparison test. Put REX High Speed Steel to work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You won't find another high speed steel that surpasses REX.

Remember, too, that even though it is widely distributed and used, REX High Speed Steel is made *only* by Crucible. So for tops in high speed steel performance, be sure you order the Crucible REX brand.

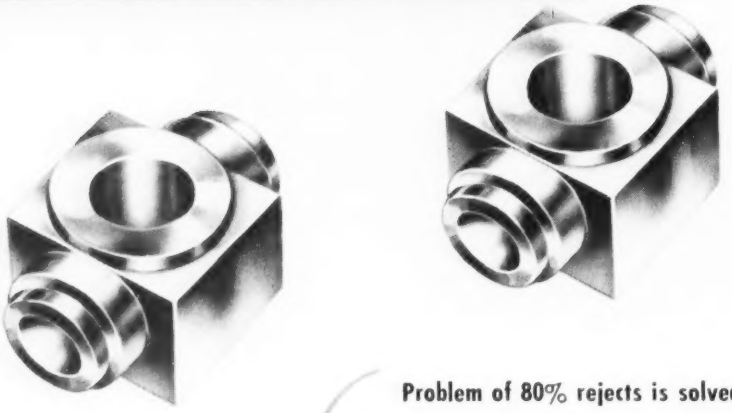
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

TOOL STEELS

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

2 Stainless Parts... *look alike*



but with 1 of them

Problem of 80% rejects is solved

This is a precision part for a military bombsight. Some of the tolerances are ±.0001". Dependability is a "must". Every factor has to be "on the nose". Yet when the subcontractor used several ordinary Type 416 Stainless steels, rejects ran as high as 80%. But then he made one change... to Carpenter No. 5 (Type 416)... and eliminated the problem.

Tool life increases

Also, tool life was short, machine downtime excessive, and production was lagging. Then one change was made—to Carpenter Stainless No. 5—and machining time was shortened, tool life raised to a trouble-free level.

Production jumps

With Carpenter No. 5 production of this part is up to schedule because the reject problem has disappeared, machining time stepped up and tool life increased. Here is just one more example of how *Carpenter quality* makes a real difference in stainless fabrication. The next time you order stainless, be sure it's Carpenter. Watch it speed production—ease headaches from first operation to the last.

Make the <u>one</u> change that counts...

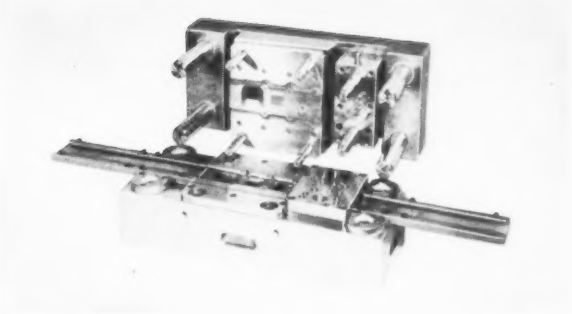
change to *Carpenter*

Free-Machining Stainless

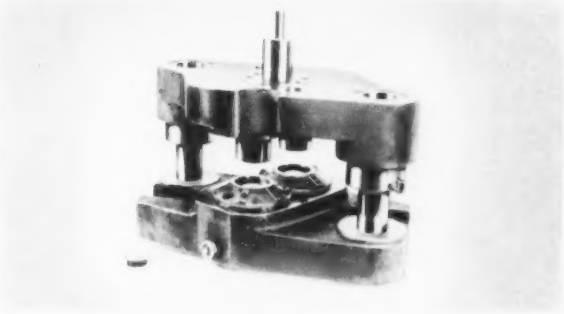
take the problems out of production

THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

For fast delivery, call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor

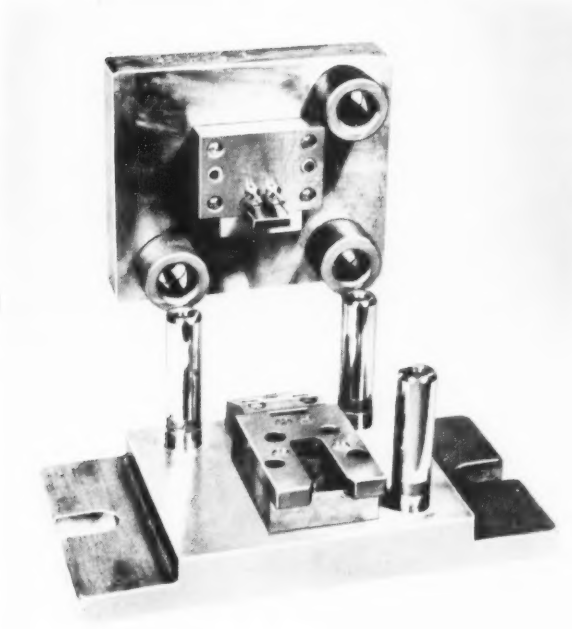


1 Lamination die, made for Schick, Inc., produces rotor and stator laminations of motor-grade silicon steel. Customer reports carbide die produces average runs 35 times as long as steel dies.



2 Blanking and drawing of screw bottle caps is done by this die for Armstrong Cork Company, Lancaster, Pa. Die operated accurately on material .006" thick for months. Steel die had to be changed each week.

Case histories show how dies reduce costs when equipped with Carboloy cemented carbide



3 Simple pierce and cutoff die, designed for Electric Auto-Lite Co., Toledo, operates at speeds faster than 400 strokes per minute. Die has produced over 2,000,000 strokes . . . and still does not require sharpening.

Actual plant performance has proved how easy and profitable it is to use Carboloy cemented carbide over a wide range of applications. For blanking, forming, drawing and piercing . . . for large or small, simple or complex dies . . . only carbides will give you benefits like these:

- **Production runs 35 times greater than steel (see picture No. 1)**
- **Accurate tolerances held for months . . . as compared to days with steel (see picture No. 2)**
- **Over two million high-speed strokes . . . without needing resharpening (see picture No. 3)**

If you wish, a member of the Carboloy Engineering Appraisal Service will call at your plant, without obligation. He'll show you how simple it is to wear-proof your dies; how to get increased production with fewer rejects. And you can send your key personnel to the Carboloy Die School in Detroit.

Also free is the Carboloy Die Engineering Manual D-124. It shows you how easy it is to design, apply and maintain carbide dies. For any of these free, cost-reducing Carboloy services or literature, send coupon below.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

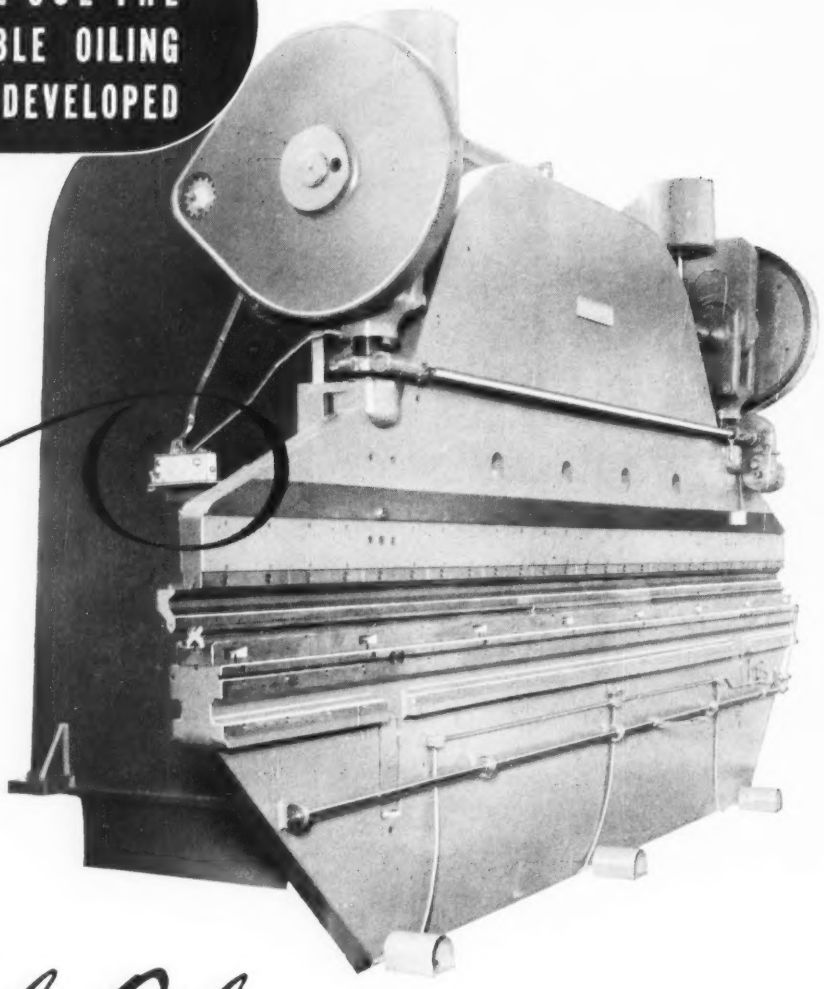
FILL OUT THIS COUPON—MAIL IT TODAY!

CARBOLOY Department of General Electric Company
11147 E. 8 Mile Road, Detroit 32, Michigan

- ☐ Rush me free Carboloy Die Engineering Manual D-124.
- ☐ Send complete details on free Carboloy Die Training School.
- ☐ Have a representative of the Carboloy Engineering Appraisal Service call at my plant, at no obligation to me.

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____
State _____

MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED



Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a 3/8" by 20' Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.

MADISON-KIPP

Fresh Oil . . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

MADISON-KIPP CORPORATION

203 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

For more information on products advertised, use Inquiry Card, page 247

your ideas

your sketches

can become parts

quicker by

Hydroforming

Hydroforming enables you to get into production faster by greatly reducing the time required to convert an "idea" into a finished or prototype part.

With Hydroforming, the "idea" may be presented as a simple sketch, from which the Hydroform tools are quickly made. These tools can be mounted in 10 minutes and part samples then run off, ready for appraisal.

Changes from original part design can be made, incurring minimum tooling costs. The versatility of the Hydroforming method makes it practical to experiment with different kinds and gages of materials using the same tooling.

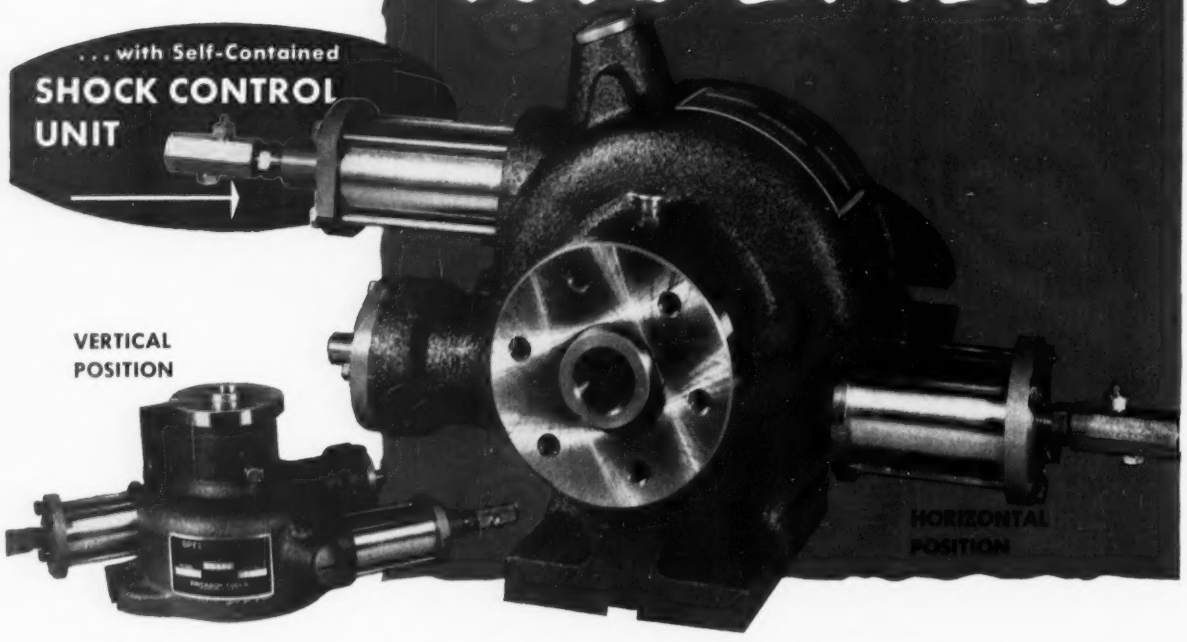
The problems inherent in producing the actual part may also be studied and solved by Hydroforming a scaled-down version of the actual part, thereby minimizing tooling cost.

Get more facts on how your company can utilize Hydroforming *profitably*. Call in a Cincinnati Milling field engineer. For a description of the Hydroforming process and specifications of the 12″, 19″, 23″, 26″ and 32″ Hydroform machines, write for Bulletin M-1759-2.

CINCINNATI Hydroform

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

NOW! A FOOLPROOF AUTOMATIC INDEXER



Designed to speed up and simplify accurate positioning, Erickson Speed Indexers are an outstanding demonstration of the modern tool engineer's ingenuity and skill.

Erickson indexers are protected by an integral shock control unit that assures constant, uniform feed . . . adjusts to meet varying loads . . . allows maximum speeds without injury to mechanism or work.

EXCLUSIVE ERICKSON INDEXER FEATURES

- Usable either vertically or horizontally
- Can be operated by air or hydraulics
- Positive lock pin independent of actuating fluid
- Integral shock control unit
- Models adaptable up to 100 positions
- Three-position indexer available for 120° locating

Write for Erickson Catalog Today!

ERICKSON TOOL COMPANY

2319Q HAMILTON AVE. ● CLEVELAND 14, OHIO

PRECISION HOLDING TOOLS • COLLET CHUCKS • TAP CHUCKS • AIR CHUCKS & CYLINDERS • EXPANDING MANDRELS • HOLDERS • INDEXERS

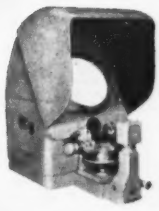
See Erickson Tools in Booth 805 ASTE Show, Philadelphia, April 26 to 30

For more information on products advertised, use Inquiry Card, page 247

11 MODELS

3 SCREEN SIZES

Pedestal Type
14" Diam. Screen



Bench Type
14" Diam. Screen
4 Models

Bench Type
5¾" x 7¾" Screen
3 Models

Unsurpassed Inspection Versatility

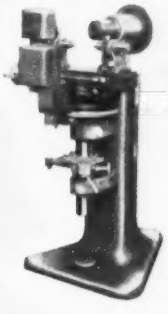
JONES & LAMSON OPTICAL COMPARATORS

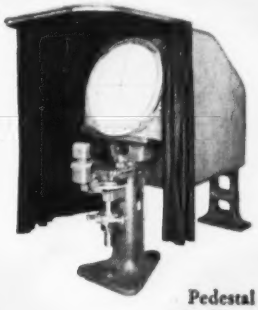
The Essence of Quality Control

Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- **They meet** the requirements of toolroom, laboratory and production inspection.
- **They precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- **They compare** intricately contoured parts with a master outline—and measure the amount of error.
- **They are convenient** to operate, easy to set up and read direct—*without computation.*
- **They operate** under normal lighting conditions. *No darkroom is needed.*
- **They will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- **They will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.

Vertical Type
14" Diam. Screen





Direct
Projection
Type

Pedestal Type
30" Diam. Screen

A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

JONES & LAMSON *Machine Tool Craftsmen Since 1835*

JONES & LAMSON MACHINE COMPANY
512 Clinton St., Springfield, Vt., U.S.A.

COMPARATOR DIV.
Dept. 710

Jones & Lamson Machine Company
512 Clinton Street, Dept. 710
Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME _____ TITLE _____

COMPANY _____

STREET _____

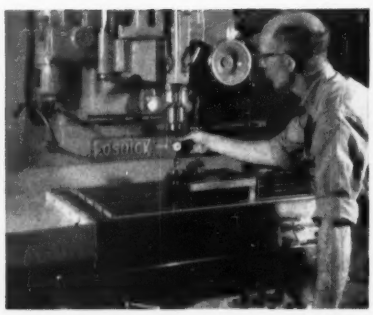
CITY _____ STATE _____

with NEW Fosdick BF Spindle

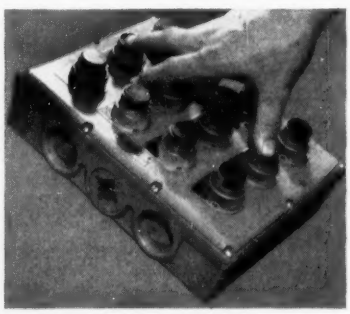
change boring tools repeat hole size

No more "cut and try" resetting of boring tools every time you change them! With the new BF Spindle you can change tools in seconds with such accuracy that hole sizes are repeated within ± .0001", *without* resetting. Slash time drastically, whether boring a "one-shot" jig with many different size holes or producing work where repetitive precision is essential.

Fast tool changing with Automatic Positioning for High-Speed, Precision Boring to a NEW Degree never before obtainable.

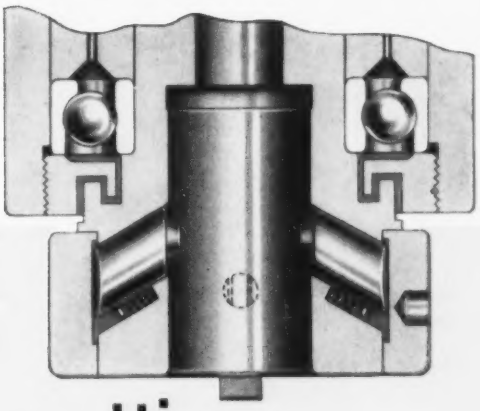


Drop duplicating bars in place—position work for first hole and bore. Then . . .



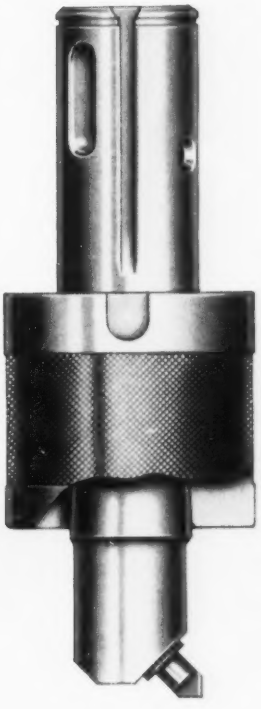
PRESS the button—and in the twinkling of an eye—you're positioned within ± .0001" for the next operation.

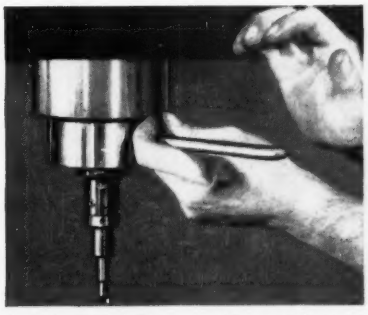
Fosdick builds Automatic Positioning into its Jig Borers to give you ± .0001" table positioning *in seconds* simply by pressing a button—even with inexperienced operators. Only two easily-made, easily-stored duplicating bars are needed for each job. Once bars are set, work initially positioned, press button and, in seconds, you're ready for the next operation! This is Fosdick's precision combination—*One hole or a thousand, same size or different, you'll hold both position and hole size to ± .0001"!*



in seconds... to ±.0001" without resetting

High-precision tool holder is built integral with Jig Borer spindle. Straight-shank tool adapters fit holder precisely – wipe surface clean as tool is inserted, keep dust and dirt from upsetting precision fit. Both adapters and tools "keyed-in" for identical repositioned accuracy.





With the BF Spindle, you can change boring tools while the machine positions. Simply loosen cam ring with spanner wrench. Further hand rotation releases tool.

Then insert new tool, tighten cam ring and you have Fosdick's precision combination—tool changing and work positioning both to ± .0001" in a matter of seconds!

Need Drilling Equipment? Get a Proposal from Fosdick!

Radial Drills

Jig Borers

Sensitive and Upright Drills

Sensitive Radial Drills

Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

CINCINNATI accurately

1/2" plate and 20 gauge sheets

...without changing knife clearance

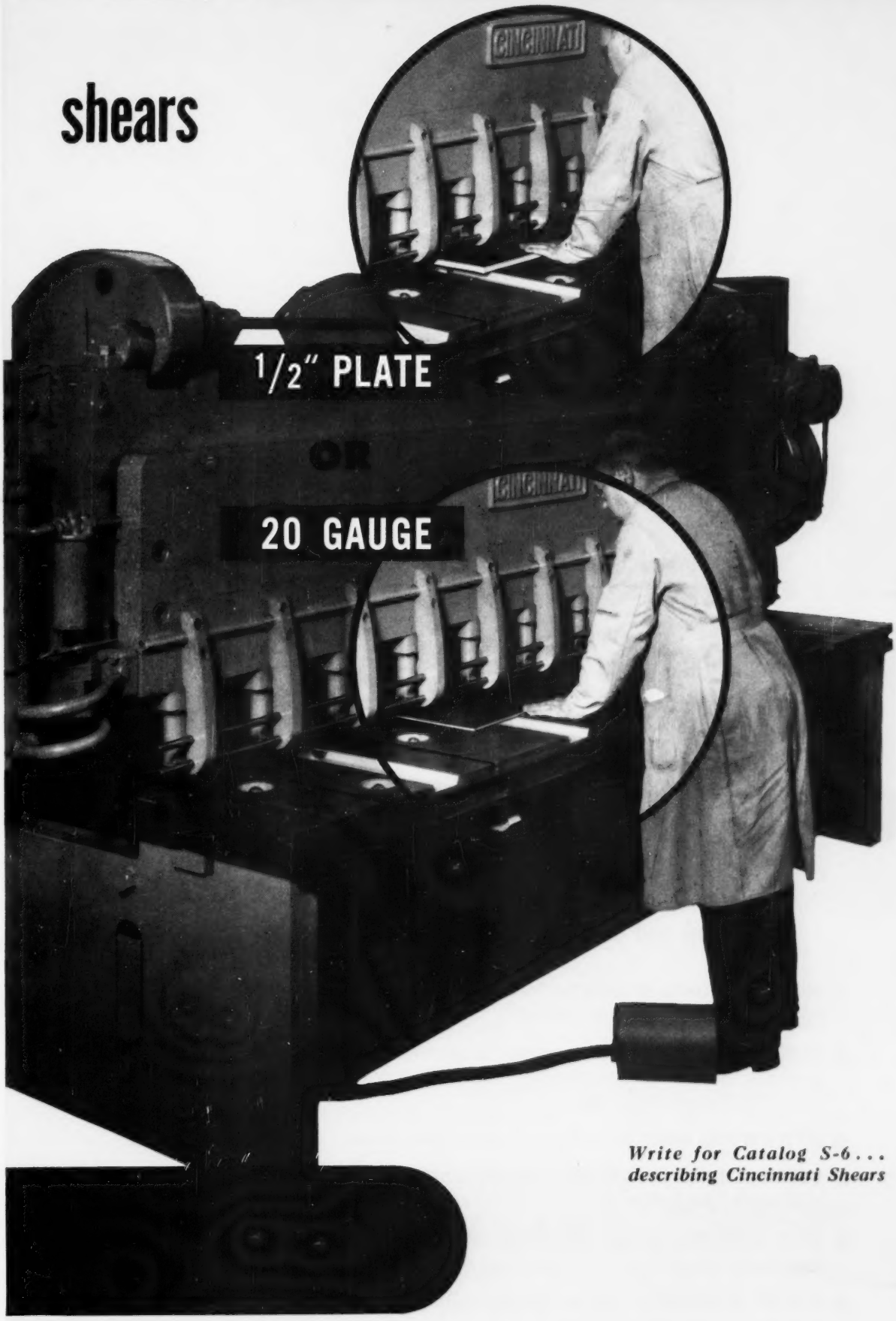
. . . You do not change knife clearance for successful shearing of different thicknesses on a Cincinnati. Just set the clearance for the thinnest material and shear all thicknesses up to capacity. Thousands of Cincinnati Shears are used continuously in this manner. This practical method prevents accidental damage — saves time. Remember, changing knife clearance interrupts production.

Investigate the Cincinnati All Steel Shear and its accurate, time-saving features, developed thru years of experience.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

shears



Write for Catalog S-6 . . .
describing Cincinnati Shears

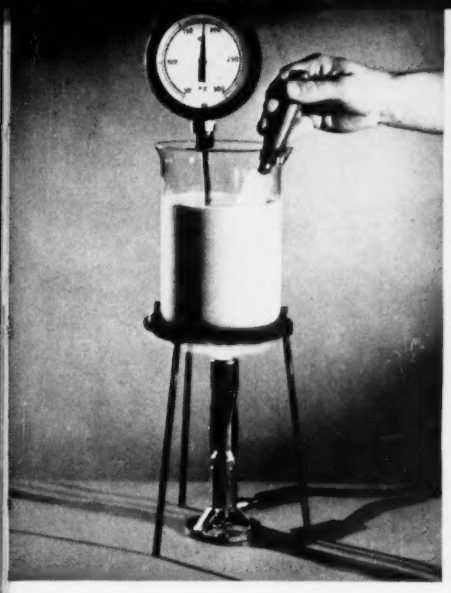
CUTTING. New S.E.C.O. keeps parts and tools cooler. Tools last longer, require fewer grindings; production is increased; finishes are uniformly good.

Now Better Than Ever!

Sunoco Emulsifying Cutting Oil

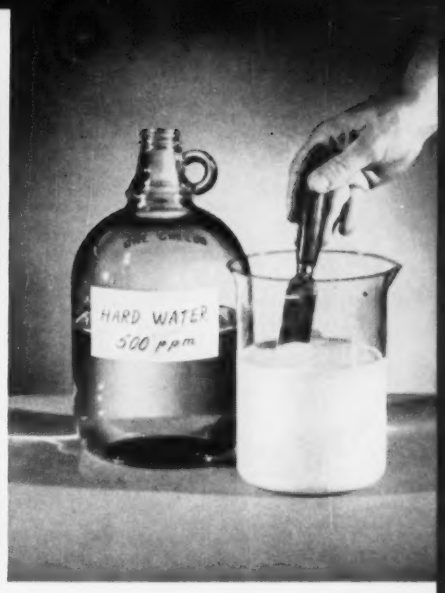
New refining facilities improve industry's most widely used cutting oil and permit it to give these added benefits

- **HIGHER MACHINING EFFICIENCY**—better finishes, longer tool life, increased production in cutting operations
- **INCREASED DETERGENCY**—particularly important in grinding operations—provides better surface finishes, prevents loading and glazing of the wheel, prolongs wheel life
- **BETTER MIXING QUALITIES**—in hot, cold or hard water
- **A PURER, CLEANER CUTTING OIL**—whiter, more stable emulsions; cleaner parts and machines; better operator acceptance
- **EASIER HANDLING**—pumps from storage tanks more readily, flows from drums faster
- **GREATER VERSATILITY**—can be used for rolling, washing and rustproofing as well as cutting and grinding

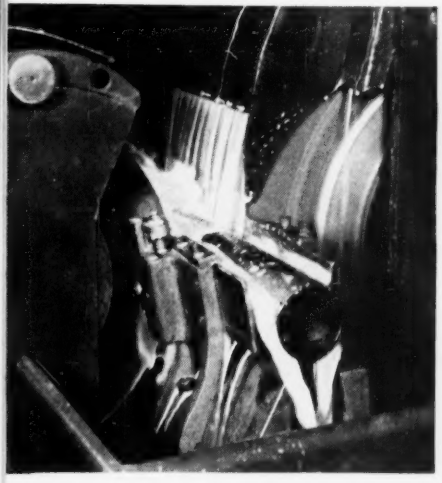


MIXES BETTER IN HOT WATER. New S.E.C.O. mixes and remains stable even at 180 F. This permits its use in washing and rustproofing.

MIXES EASILY IN COLD WATER. New S.E.C.O. forms stable emulsions in the coldest water . . . even ice water does not affect it.

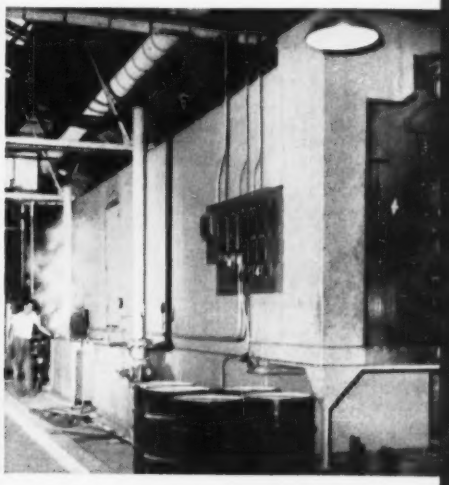


MIXES READILY IN HARD WATER. New S.E.C.O. eliminates the need for special hard-water grades of emulsifying cutting oil.



GRINDING. New S.E.C.O. improves surface finishes because its increased detergency prevents loading and glazing of grinding wheels, prolongs wheel life.

RUSTPROOFING. New S.E.C.O. is a better hot rustproofing medium. It forms stable emulsions, coats metal parts uniformly, protects them against rusting.



WASHING. Because of its increased detergency and its ability to mix and remain stable in hot water, New S.E.C.O. is better for removing grease and dirt from metals.

TEST THIS NEW S.E.C.O. IN YOUR OWN PLANT. For more information, call your nearest Sun office or write SUN OIL COMPANY, Phila. 3, Pa., Dept. M-3.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Made by the producers of famous Blue Sunoco Gasoline and Dynalube Motor Oils

Form Grind your parts like these...

ENGINEERING AND DESIGN

Complete design and development work; prototypes. Manufacture of gears, splines, and many other types of parts, as well as complete gear box assemblies. **Send your blueprints now.**

CONTRACT GRINDING SERVICE

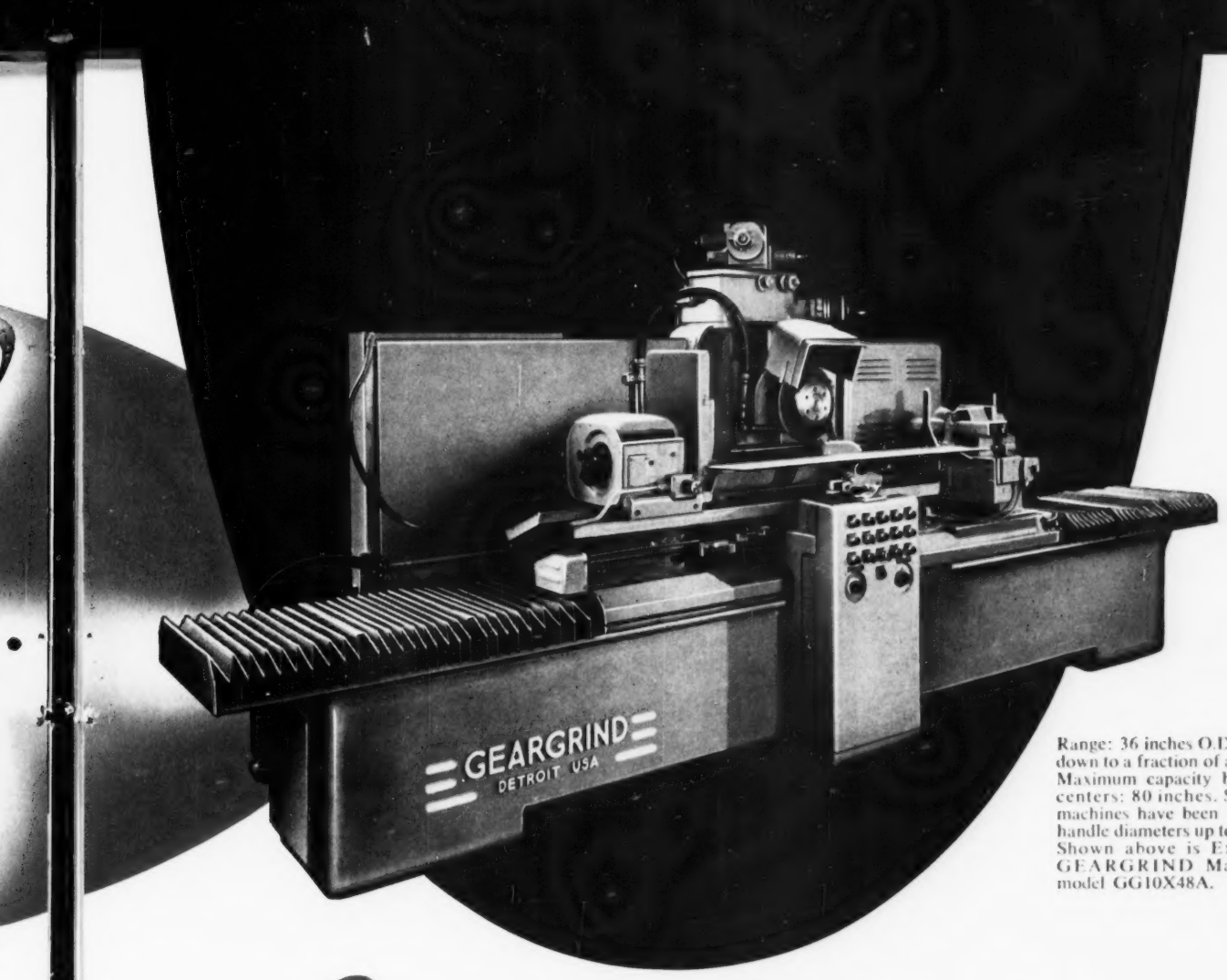
If you prefer to send out your gears and other precision ground parts for grinding, GEARGRIND'S Contract Grinding Division is your most economical source. Service is quick!

CORRECTIVE (SALVAGE) GRINDING—

For parts made by other methods, distortion in heat treating and errors in machining often cause needless scrapping of gears, splines, and many special-contoured parts. Let GEARGRIND'S Corrective (Salvage) Grinding Service save them for you.

WRITE FOR FOLDER ON GEARGRIND'S CONTRACT GRINDING, ENGINEERING AND DESIGN SERVICE.

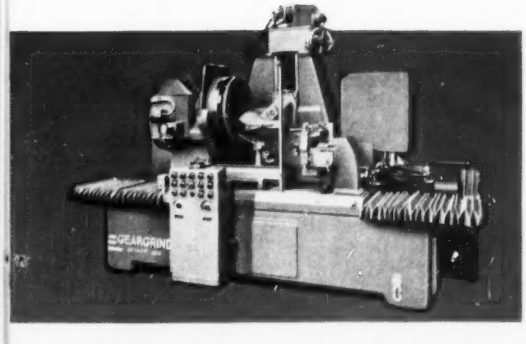
GEARGRIND *Detroit*



Range: 36 inches O.D. blank down to a fraction of an inch. Maximum capacity between centers: 80 inches. Special machines have been built to handle diameters up to 6 feet. Shown above is External GEARGRIND Machine, model GG10X48A.

...on Geargrind Automatics

For Speed and Versatility



*Internal GEARGRIND Machine, model GGI-16-3A

Actual operating experience shows: these automatic GEARGRIND Machines will equal or exceed the **continuous production rate** of other similar-purpose machines. And, they will do a greater variety of work: **aircraft, automotive, machinery, etc.**

SEE GEARGRIND'S NEW AUTOMATICS AT WORK!
COMPARE THEIR SPEED, ACCURACY, AND VERSATILITY
OR—SEE THEM PICTURED AND DESCRIBED

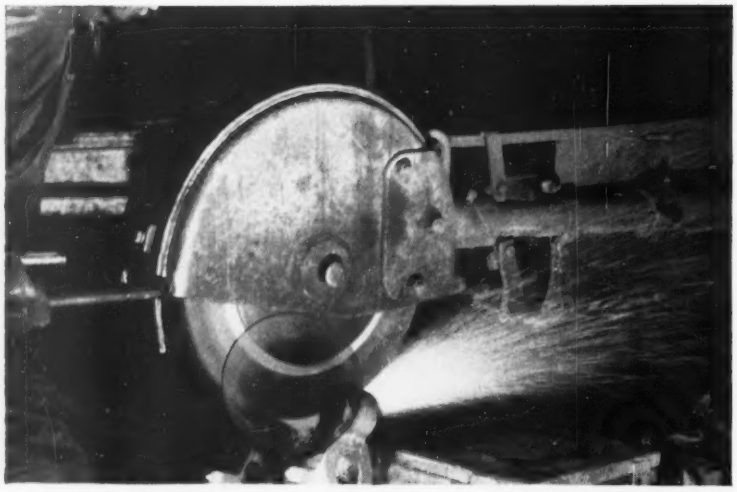
—with the complete line of machines, pioneered and developed over 45 years by Geargrind, in the new 8-page catalog. It's yours for the asking . . . write on your company letterhead, please.

THE GEAR GRINDING MACHINE CO.

3921 CHRISTOPHER, DETROIT 11, MICHIGAN

Brighten your rough grinding picture with this profit-boosting

"TOUCH of GOLD"



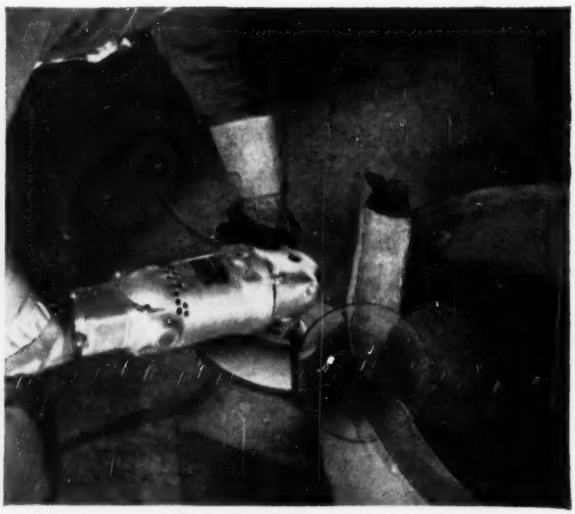
FOR YOUR SWING FRAME GRINDING, Norton wheels take heavy pressures and high speeds in stride. Their fast, clean-cutting action and extra long life assure more metal through your cleaning room per man-hour.

Profits from grinding actually begin with the first, most basic grinding operation — snagging. Yet the profit-potentials of rough grinding are apt to be more neglected than any other.

In your own rough grinding, Norton wheels can help bring every job up to its proper money-making level. Because you can get Norton wheels that are exactly right — in abrasive, in bond and in every other detail — for best results on all your jobs.

For proof, test Norton wheels against any others, under the same conditions. Your operators will like their easy-handling, clean-cutting action. And *you'll* like the way they grind off more metal per dollar, turn out better work and increase your production — bringing the real,

FOR YOUR BENCH AND FLOOR STAND GRINDING, Norton wheels combine exceptional cutting qualities with consistent wheel economy in a way that makes your grinding look good and your costs look better.



FOR MANY OTHER GRINDING JOBS, use Norton Nylon-Reinforced Hub Wheels — BD rigid and BFR semi-flexible. For work ranging from notching risers to weld finishing, they're the lightest, easiest, safest wheels made.

profit-boosting "Touch of Gold" to your rough grinding.

Your Norton Distributor

will gladly help you select the right wheels for your jobs and your machines. If necessary, he'll call your Norton Abrasive Engineer for expert advice on new or difficult applications. And with the world's broadest line to choose from, you'll get the wheels you need for better, lower cost grinding.

Booklet No. 1405 contains over 50 illustrated pages, covering every phase of rough grinding — including *your* jobs. Get it from your Norton Distributor. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1541

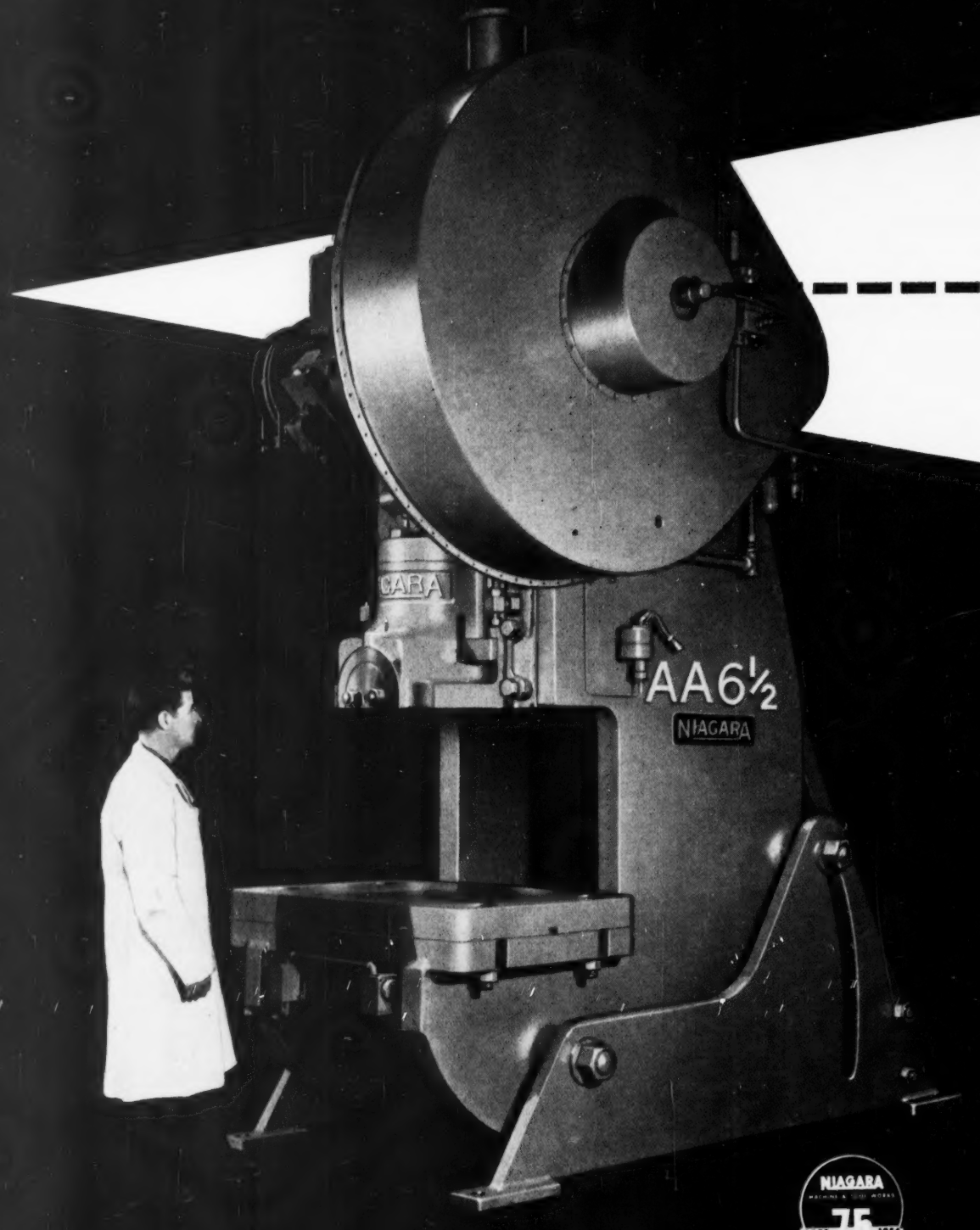
NORTON
ABRASIVES

Making better products . . .
to make other products better

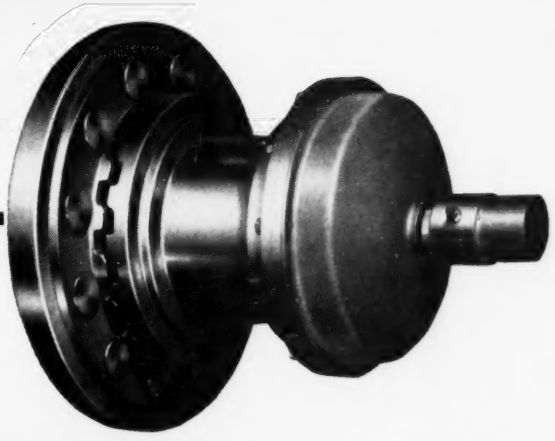
*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

FOR YOUR PORTABLE GRINDING, Norton wheels have the inbuilt balance that reduces vibration and bounce, and makes them "hug that work." Results are faster grinding, longer wheel life, less operator fatigue — advantages that show up in your profit column. Use Norton ALUNDUM* abrasive on steels and steel alloys, CRYSTOLON* abrasive on gray iron and non-ferrous metals.

IT'S HERE!



..a great, new line of inclinable presses



FEATURING
the exclusive Niagara Electro-Pneumatic Clutch

- Combines prime advantages of friction and mechanical sleeve clutches.
- Has no friction surfaces to slip, heat or wear.
- Provides a positive drive that engages or disengages instantly, at any point in stroke.
- Can be single-stroked, jogged or run continuously.
- Operates effortlessly by palm buttons or foot switch.
- Stops automatically if power or air pressure fails — an important safety feature.

Never before in O. B. I. Press history, has there been so significant a development as this new Niagara line . . . Series AA. Built in eight sizes, with shaft diameters from 3 to 7½ inches, it has set a new high for performance and stamina in blanking, forming, drawing, perforating, combination die and automatic feeding operations.

Get the complete story. Send for literature. Talk with our representative. SEE the press in action. Compare! Then, decide.

AND YOU'LL FIND ALL THE FACTS IN HERE!
BULLETIN 57-A
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NIAGARA

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

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DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA
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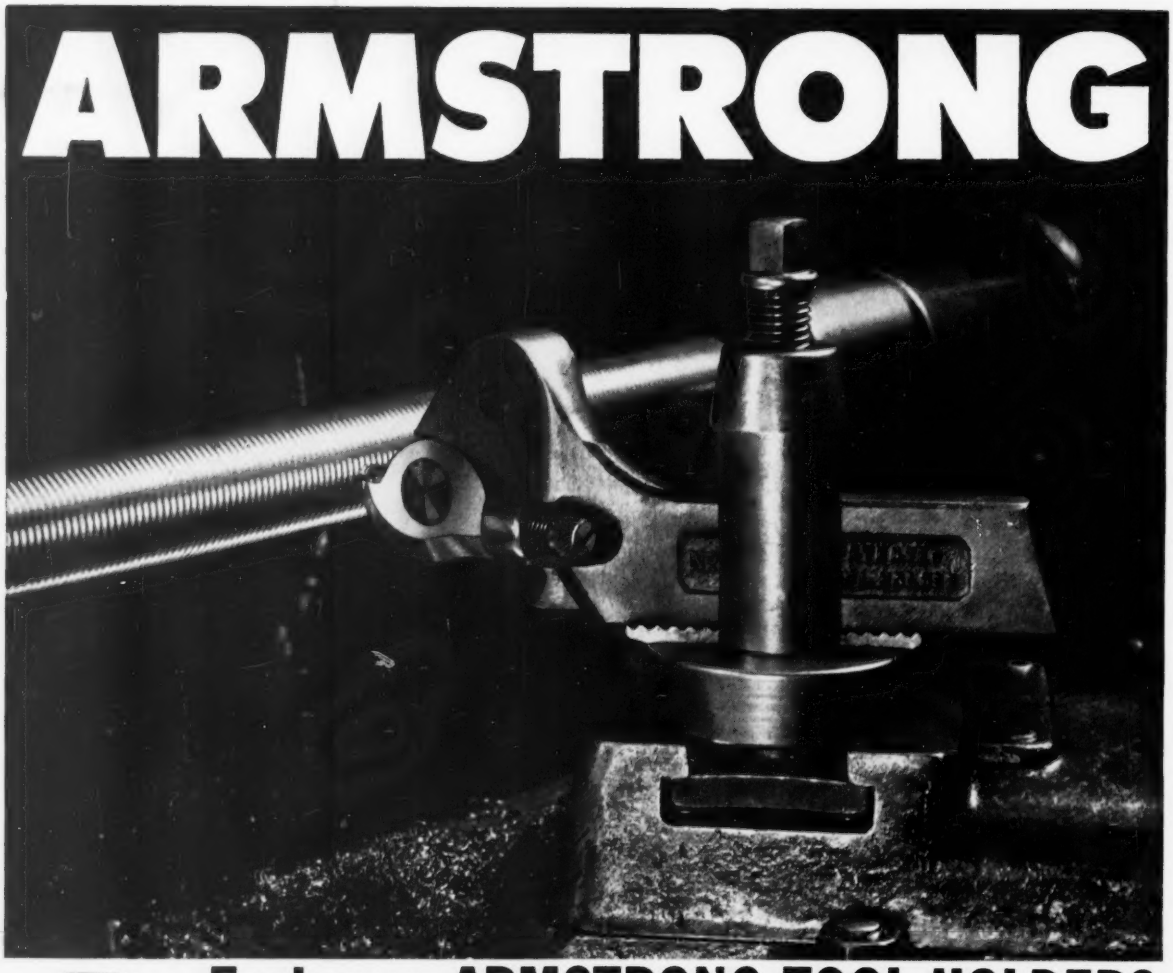
ARMSTRONG



The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Write for catalog

Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

Buy **ARMSTRONG TOOLS** from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

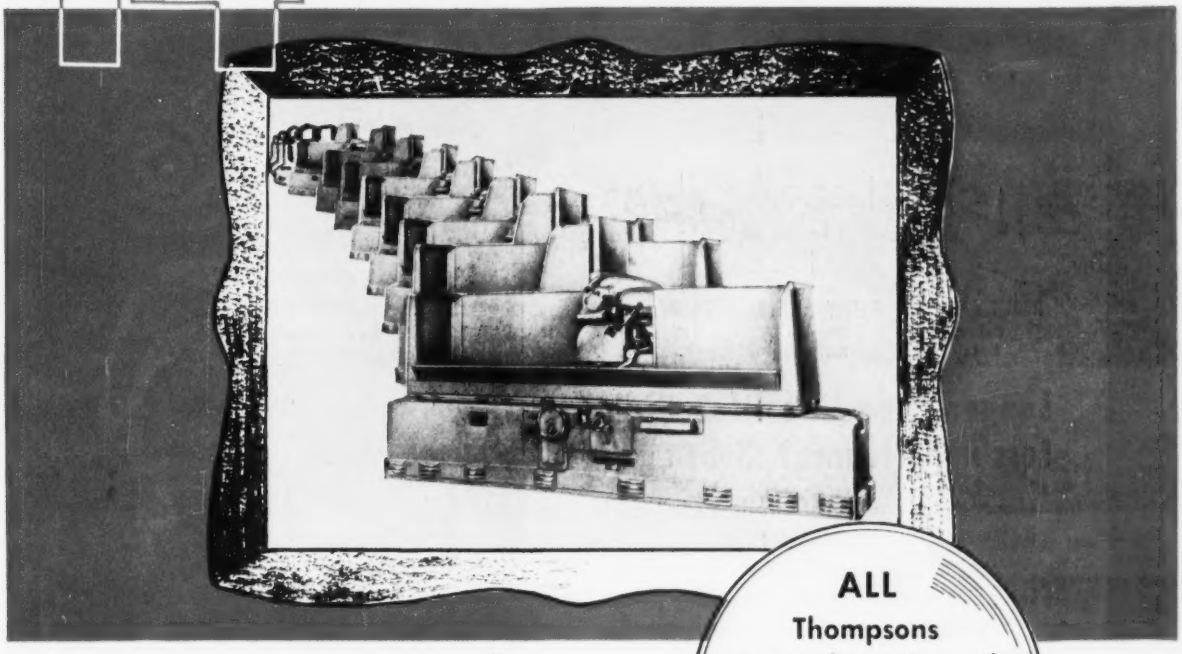
5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

For more information on products advertised, use Inquiry Card, page 247

LOOK CLOSELY AT THIS PICTURE
OF GRINDER PRODUCTION AND SEE WHY...

14 *is a lucky number*

for a manufacturer requiring precision grinding



ALL Thompsons operated continuously with much LESS DOWNTIME

thats why

it will pay you to invest in

Thompson Grinders

After twelve years continuous manufacture of precision ground products, ten Thompson Surface Grinders proved so efficient and economical that this manufacturer ordered four more machines.

Thompson Grinders are available in a wide range of types and sizes from 6" x 18" to 72" x 384" to meet all production, special or tool room grinding requirements. The Thompson line includes machines from giant Hydrial Way Grinders to automatic Truform Jet Blade Contour Grinders, Dual Rotary Grinders and Broach Grinders.

CONTACT THOMPSON TODAY FOR HELP WITH YOUR MACHINING PROBLEMS

THE THOMPSON GRINDER COMPANY
Springfield, Ohio

For more information on products advertised, use Inquiry Card, page 247

right from every angle . . .

RIGHT ANGLE
Roller
Ends

RIGHT ANGLE
Bearing
Surfaces

RIGHT ANGLE
Separator
Slots

Longer operating life? Right!
Less maintenance? Right again!

Heavy-duty equipment "rolls right" with Rollways because . . .

. . . solid cylindrical rollers provide the long line-contact required by heavy loads.

. . . precisely made ends, bearing surfaces and retainer slots restrict end-rub, skew and side-shock.

. . . special alloys in the races resist spalling and brinelling.

It all adds up to a bearing that rolls longer, takes less maintenance, prolongs the life of your equipment.

ROLLWAY BEARING CO., Inc.
SYRACUSE, N. Y.

• No charge or obligation for our bearing recommendations. Bearing replacement distributors in principal cities—consult classified phone directory.

ROLLWAY
BEARINGS

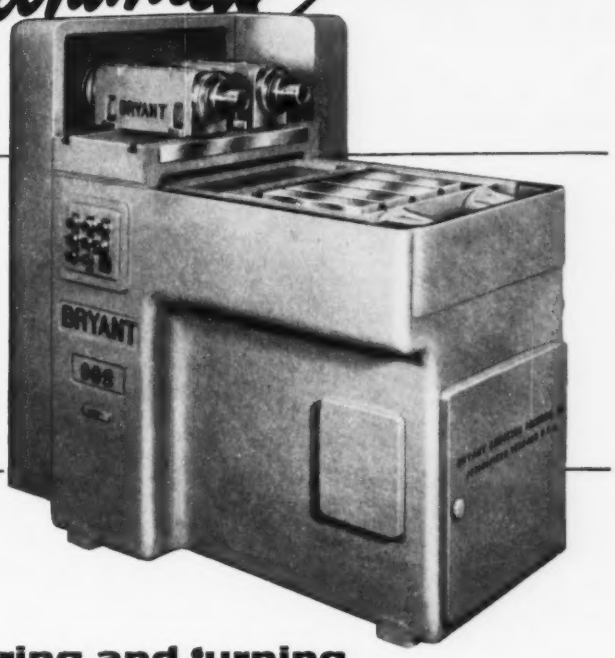
Complete Line of Radial and Thrust Cylindrical Roller Bearings

SALES OFFICES: Boston • Chicago • Cleveland • Detroit • Houston • Los Angeles • Philadelphia • Pittsburgh • San Francisco • Seattle • Syracuse • Milwaukee • Toronto

For more information on products advertised, use Inquiry Card, page 247

THE BRYANT 6" STROKE *all Mechanical* BORING MACHINE

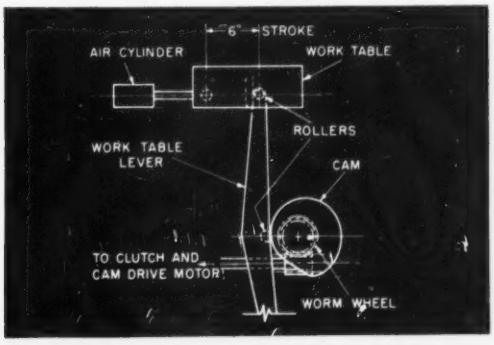
gives you



uniform accurate production

in precision boring, drilling, turning, facing, grooving and contour boring and turning

Higher Production Rates — The Bryant 998 is designed specifically to give rapid production with constant repetitive accuracy. The table is actuated by a simple cam and lever unit which provides positive control of the cycle at all times. This mechanical actuation of the table eliminates variation in the cycle due to temperature change. An air cylinder exerting uniform pressure directly on the table keeps the cam follower roll in steady contact with the cam, thus preventing backlash and jump. Cycle may be semi-automatic or automatic.



Finer Finishes — The Bryant 998 provides smooth, uniform table motion, an essential factor in generating a fine finish with a single point tool. The table moves on two 4" diameter solid steel slide bars firmly bolted to the bed. Each bar has two anti-friction preloaded ball bearings providing a metal-to-metal contact which eliminates slight shifting due to the presence of an oil film. The boring head spindles rotate in special super-precision ball bearings. These are spring-loaded, to ensure maintenance of spindle alignment during both boring and facing operations.

Less Down-Time — The Bryant 998 requires minimum maintenance. Motors, boring heads and slides are permanently grease sealed. This simple mechanical design is easily understood, and the units are accessible for maintenance.

Mail coupon for complete details!

BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VT.

Gentlemen: Please send me your Bulletin 998. M

Name.....

Title.....

Company.....

Street.....

City.....Zone....State.....

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

For more information on products advertised, use Inquiry Card, page 247

Scully-Jones announces

Locks and ejects tools faster, easier . . .

gives more positive collet action, freer float!

Now . . . you can compensate for misalignment between tool and work on multiple-spindle operations, simplify and speed tool changes, get a true, powerful collet action on taps and reamers with this new Floating Holder—the Scully-Jones "JT" Lock and Eject Type—which gives you all these advantages.

The proved and much-used double-gear spline drive principle—same as used in the "JA" Floating Holder—helps improve quality of work and reduce tool damage by providing *free float* in all directions . . . no "dead spots" or binding.

New "lock and eject" type chuck permits easy tool changes by turning threaded ball-bearing nut on nose of holder. Chuck and cutting tool may be ejected *together* or *separately*, more quickly and efficiently than ever before! Threaded "lock and eject" nut stays on holder and eliminates use of drift.

Small body diameter permits close center work. Short body projection requires minimum overhang between spindle and work. Quick-lock nut on adjustable shank provides quick, accurate adjustments. Positive lubrication during operation practically eliminates wear and assures dependable operation throughout long life. Centering pin (when required) prevents whip and chatter. Efficient seal on shell keeps grease in and dirt out.

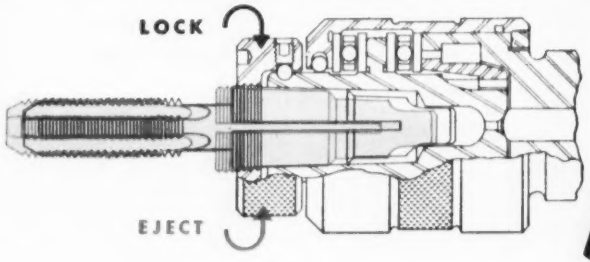
Call your nearby Scully-Jones representative or distributor—Factory-Trained "Precision Tool and Work Holding Specialist"—for complete information and service.

New Scully-Jones "JT" Lock and Eject Type Floating Holder

Improve work quality, reduce tool damage

Misalignment is corrected by floating and driving elements, separated to provide equal freedom of movement in all directions. Helps eliminate bell-mouthed, out-of-round, or poorly finished reamed holes. Guards against oversized and tapered threads. Reduces cramping and bending action on cutting tools, premature dulling, breakage and downtime.

LOCK AND EJECT IS SIMPLE AND FAST . . . NO DRIFT NEEDED!



New "lock and eject" design—Threaded nut on nose of holder revolves freely on ball bearings, drawing threaded chuck into taper seat and compressing it evenly on shank of cutting tool. Chuck and cutting tool may be ejected *separately* or *together* by reversing rotation of threaded nut. Spanner wrench holes on O.D. and face of threaded ball bearing nut permit easy tool changes, even in a close cluster of spindles.

NEW Floating Holder!

New multiple-spindle Transfer Unit, for drilling and reaming V-8 cylinder blocks, is "factory-equipped" with Scully-Jones "JT" Lock and Eject Type Floating Holders. Manufacturer — Greenlee Bros. & Co., Rockford, Ill.

SCULLY JONES

Precision Holding

FOR HOLDING PRECISION

Scully-Jones and Company, 1906 South Rockwell Street, Chicago 8, Illinois

MORE FACTS—Send for catalog describing Scully-Jones Precision Holding Tools. Paste coupon to letterhead or post card and mail today.

Gentlemen: I'm interested in learning more about Scully-Jones Tools.

☐ Please send information on "JT" Floating Holders.

☐ Send catalog on your complete line.

Name_____

Company_____

Address_____

City_____ State_____

"It can't be done.

You can't drill small holes and large holes at the same feed and speed."

"Well, let's see.

What do you pay off on? Feed? No! Speed? No! Production? YES!! —on your tooling cost and finished parts per hour."

DON'T YOU AGREE?

EXAMPLE (and it's extreme)

Drill stand has 30 holes 1/16" through 1/2" diameter. Completely drilled in two passes with two Zagar gearless drill heads, 16 spindles per head. All spindles run at 1200 r.p.m.

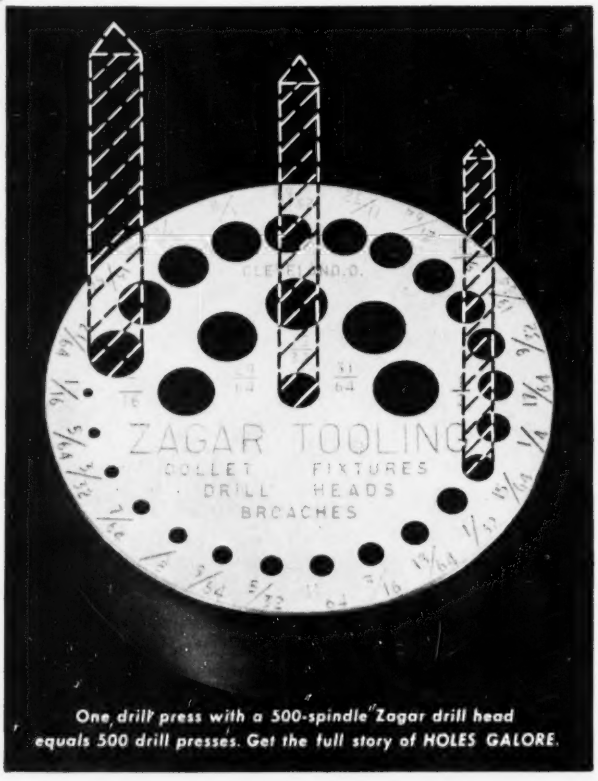
Conventional multi-speed method. So-called ideal speeds would be not less than three times as fast for the 1/16" drill as for the 1/2" drill. Ideal drill feed would be three times as heavy for the 1/2" as for the 1/16". Moreover, six passes would be necessary.

Zagar single-speed method. Only two passes. Feed is held down by strength of 1/16" drill, and speed is held down by 1/2" drill. Simplified operation; fewer indexes; far less handling. Production is at least tripled. Tooling costs drop enormously.

If you don't agree, what's your version?

★ ★ ★

WRITE FOR CATALOG "M-3".



One drill press with a 500-spindle Zagar drill head equals 500 drill presses. Get the full story of HOLES GALORE.

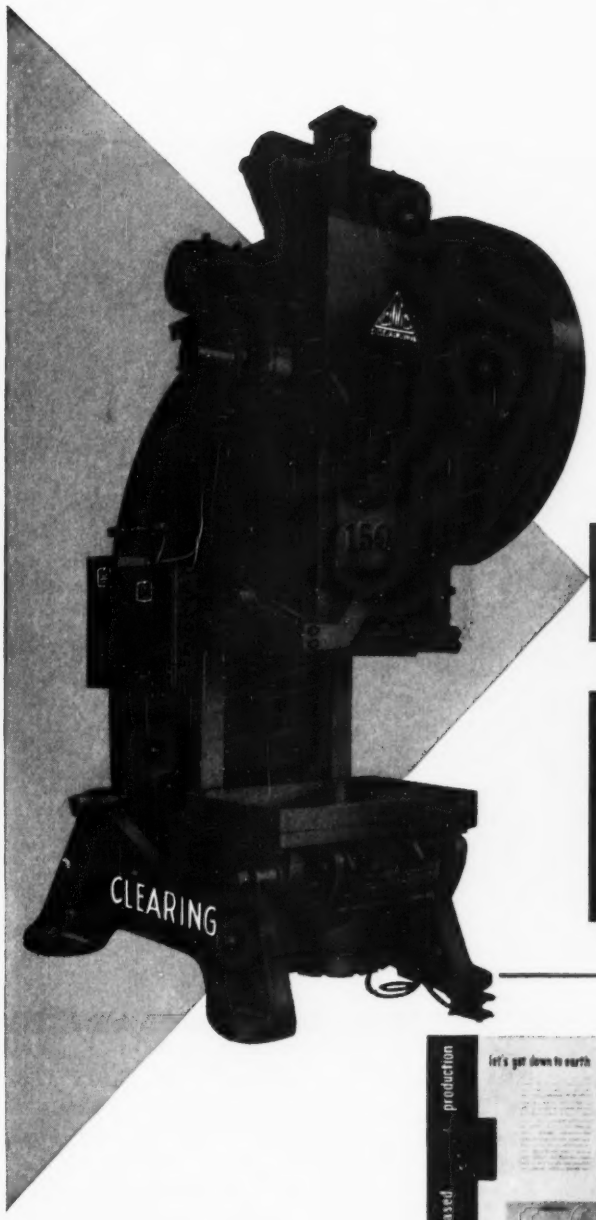
ZAGAR TOOL, INC.

24000 LAKELAND BLVD. • CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

For more information on products advertised, use Inquiry Card, page 247

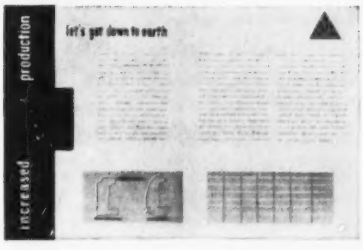
HOW does O.B.I. construction affect your profits?



The results you get, the time you save, the profit you make, on an inclinable press run depends to a large extent on how that press is built. Clearing engineers have developed a press with a type of frame, construction materials, ram guiding, controls and other important features, which gives you the highest possible productivity in stamping work.

GET THE FACTS!

Clearing's new O.B.I. catalog gives full specifications and dimensions — explains construction of important press features such as frame, clutch, brake and controls. Write for it without obligation today.



These pages from the new catalog tell how press frame construction affects the number of parts obtainable on a press run — explain press construction in terms of the results you want — increased production.

CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • 6499 West 65th Street, Chicago 38, Illinois • HAMILTON DIVISION, Hamilton, Ohio

This little red wagon presented a big drawing problem!

A Standard engineer's advice helped cut rejects by over 90%

● In the manufacture of children's wagons at the Steger Products Manufacturing Company in Steger, Illinois, 20-gauge cold rolled steel is drawn to a 4½" depth. Of the 8-hour shift capacity of 1600 to 1800 wagon bodies, up to 20% formerly wound up as rejects. Also, it was necessary to clean the dies after every 10 to 15 bodies. A single small scratch on the die caused excessive die galling and torn or ruined bodies.

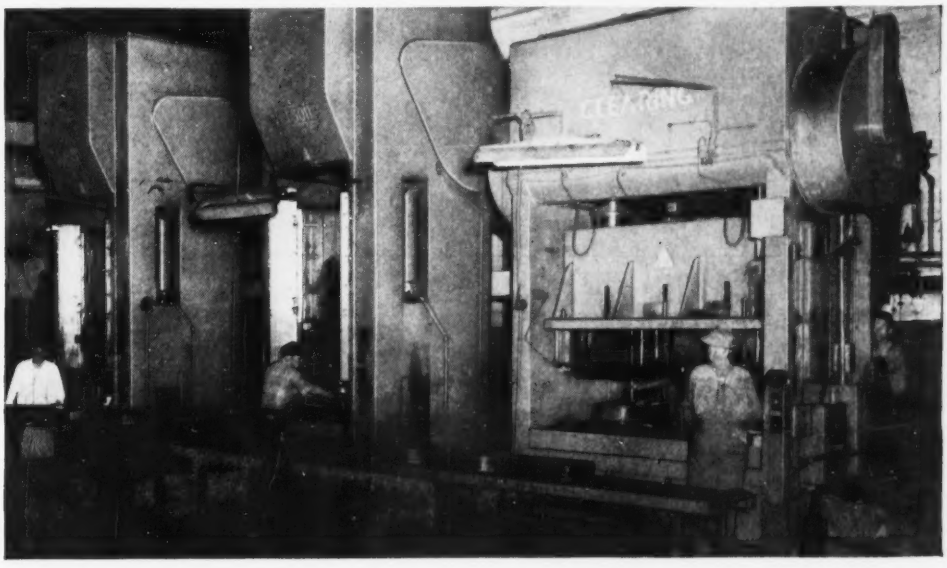
The company tried 10 or more drawing compounds without solving the problem. Then a Standard Cutting Oil Engineer suggested STANICOOL HD Soluble Oil.

That was six years ago and STANICOOL HD is still on the job. The reject rate has been reduced to less than 1% a day. Die galling has come down to almost nothing. Dies are now cleaned only once or twice daily. Again, Standard Oil's metalworking products prove they can do the hard jobs better!

STANICOOL HD Soluble Oil: for cutting and grinding operations, for certain forming operations. Mixes readily, non-irritating, anti-rust. To take full advantage of this many-purpose cutting fluid, call on the services of your Standard Oil Cutting Oil Engineer. If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois, to secure the services of the Standard Cutting Oil Engineer nearest you.

Standard's Bill Easterwood worked with the Steger Company on their drawing problem. Specially trained, Bill Easterwood is one of a corps of cutting oil and lubrication engineers headquartered near your plant throughout the Midwest. There's a specialist to assist you with *your* lubrication problem.

At Steger, die cleaning is of major importance because a single scratch can result in torn or ruined bodies during the processing. Since the introduction of STANICOOL HD, the time-consuming die-cleaning operation has been safely reduced to an *effective* minimum.

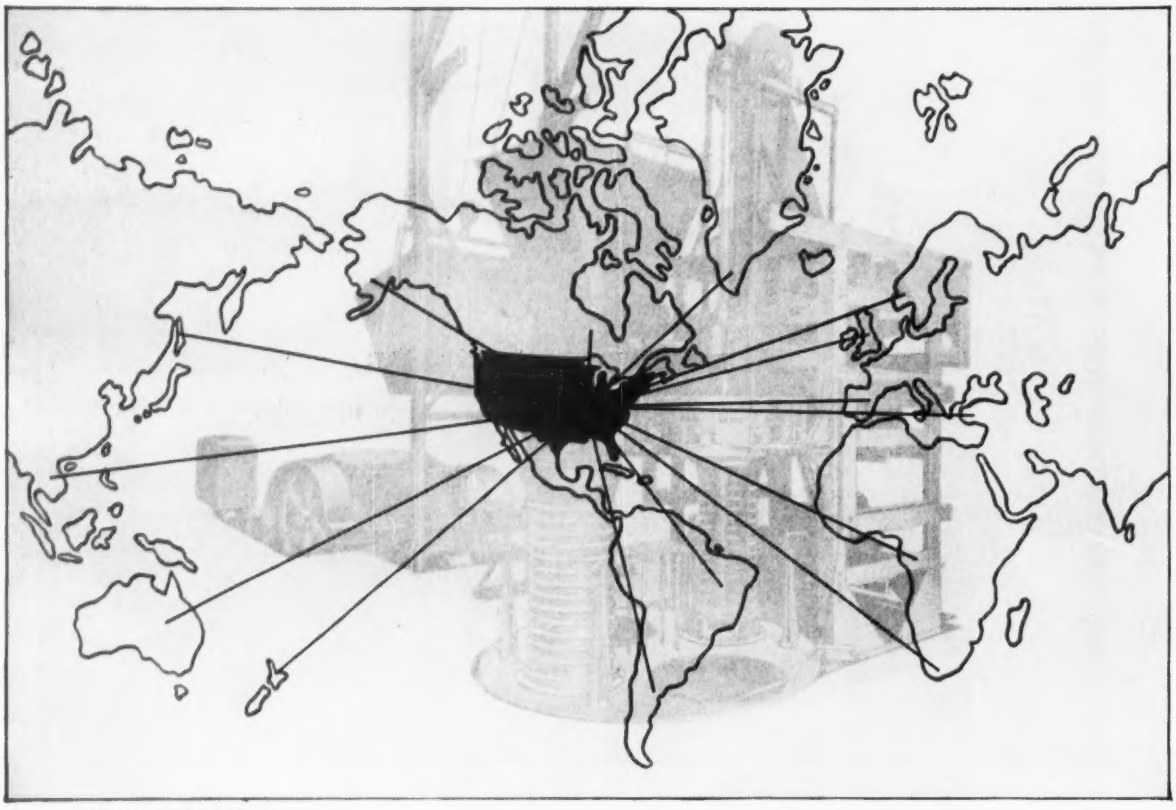


In this deep-draw operation STANICOOL HD is used just as it comes from the barrel without the addition of water. The 22-gauge cold rolled steel is drawn to a depth of 4½". The sheets are dabbed with STANICOOL HD as they are put on the press. Breakage which formerly had been a major problem has been reduced to a point where it is no problem at all.

STANDARD

STANDARD OIL COMPANY *(Indiana)*

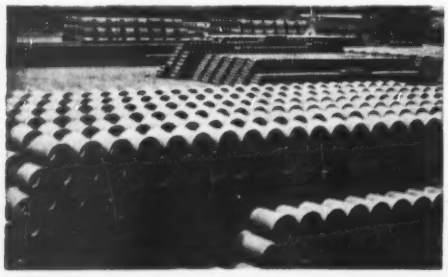
A complete line of metalworking products including: STANICUT Cutting Oils—Special duty cutting oils with correct proportions of extreme-pressure and friction-reducing ingredients. STANOSTAMP Compounds—Three established products for stamping or heavy drawing operations on either low-carbon or alloy steels. SUPERLA Quenching Oil—For quenching work on systems where cooling facilities are limited and bath temperatures are high; efficient quenchings of large forgings.



From Sioux City, Iowa:

CITIES SERVICE OILS AND GREASES SENT ALL OVER THE WORLD WITH McCRACKEN MACHINES!

"**OUR FINISHED MACHINES** are completely serviced with Pacemaker 2 hydraulic fluid, Optimus 4 oil in the transmission and Trojan M for bearing grease."



CORRUGATED CONCRETE PIPES, used for sewer, culvert and irrigation work, are one of industry's most vital tools. McCracken Machines make the very finest.

ONE CITIES SERVICE PRODUCT SOLD MANUFACTURER ON THE COMPLETE CITIES SERVICE QUALITY LINE!

During the early part of World War II, Concrete Pipe Machinery Co., manufacturers of McCracken Machines, called in a Cities Service Lubrication Engineer for answers to some tough metal-cutting problems. On his recommendation, they tried Cities Service Cutting Oil, Chillo 93. Finished work was so improved and tool life so prolonged, that Concrete Pipe had a complete lubrication survey made of their plant.

THIS CAREFUL SURVEY PROVED THAT THE COMPLETE CITIES SERVICE LINE COULD DO THE BEST JOB FOR THEM. Electric motors, spindles, gear reducers, air compressors . . . drilling, grinding, machining of cast iron parts, threading, tool and die work . . . hydraulic systems, bearings, transmissions . . . Cities Service Industrial Oils, Greases and Cutting Oils did better on every job! Concrete Pipe Machinery Co. says: "They are giving us outstanding service, and availability and delivery have always been excellent."

If you'd like to talk to a Cities Service Lubrication Engineer, write Cities Service Oil Company, Sixty Wall Tower, New York 5, New York, or call the office nearest you.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more information on products advertised, use Inquiry Card, page 247

for machining, grinding and presswork

A UNIVERSAL COOLANT-LUBRICANT

GRINDING COSTS CUT 4 WAYS

WITH SHEAR-SPEED SOLUBLE OIL

✓ less down-time
✓ longer wheel life
✓ fewer wheel dressings
✓ more parts per dressing

Convince yourself of the **amazing** advantages and versatility of SHEAR-SPEED Soluble Oil in your own plant. Sold only on a **satisfaction guaranteed** test basis. Write for **Bulletin SO-53** and price list.

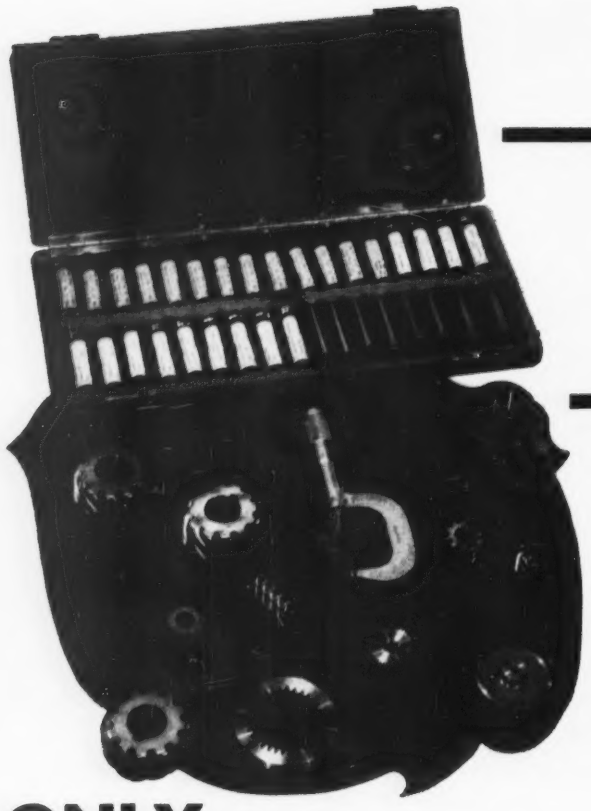
IMPARTIAL TEST RESULTS: two highly-rated soluble oils vs. SHEAR-SPEED Soluble Oil tested under similar conditions in actual production of machine tool parts.

same machine and coolant flow all tests; parts 65 Rockwell C; vitrified 60 grit wheel @ 6280 sfpm.

	Soluble X	Soluble Y	SHEAR-SPEED Soluble Oil	S/S Soluble Oil Gave this:
Wheel Loading	Very Rapid Loading	Rapid Loading	No Loading	55% Increase Depth of Cut
Finish	Finish Grind Required	Finish Grind Required	No Finish Grinding	Lower Cost Per Piece
Coolant Temperature	Rapid Increase	Rapid Increase	Very Slight Increase	Decreased Work Distortion

SHEAR SPEED
CHEMICAL PRODUCTS

7125 E. McNICHOLS RD. *A Division of Michigan Tool Co.* DETROIT 12, MICH.



THE Van Keuren GEAR MEASURING SYSTEM

Set 26EX—Gear Measuring Wires, accurate to ± .000025", for common diametral pitch external spur gears.

VAN KEUREN GEAR MEASURING WIRES PROVIDE THE MOST ACCURATE AND LOW COST METHOD OF MEASURING THE TOOTH THICKNESS OF SPUR AND HELICAL GEARS, INVOLUTE SPLINES AND INVOLUTE SERRATIONS.

ONLY . . . EQUIPMENT NEEDED:

1—SET VK MEASURING WIRES
1—MEASURING INSTRUMENT

Complete information regarding the use of Gear Measuring Wires is contained in a 50-page section of the Van Keuren CATALOG and HANDBOOK No. 35. Included in this section are:

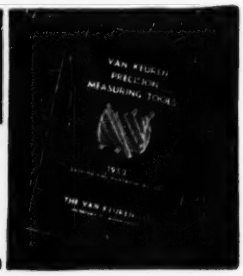
- . . . table of wire sizes for the 1.92", 1.728", 1.68" and 1.44" series.
- . . . tables of wire measurement including change factors for standard external and internal spur gears of 14½°, 17½°, 20°, 25°, and 30° pressure angles and of from 5 to 500 teeth.
- . . . table of relationships between depth of cut and tooth thickness for common pressure angle gears.
- . . . definitions and exact formulas covering involute spur gears.
- . . . tables of involute tooth parts for standard addendum and stub tooth involute gears.
- . . . information, formulas and examples regarding the wire measurement of helical gears.
- . . . information and examples concerning the wire measurement of enlarged pinions and reduced gears.
- . . . tables of wire measurement for involute splines.
- . . . tables of wire measurement for involute serrations.
- . . . tables of comparative measurement over three sizes of wires for use in involute profile checking.

CATALOG and HANDBOOK No. 35 is available without charge by writing to: The Van Keuren Co., 178 Waltham St., Watertown, Mass. Ask for your copy.

VK
35th YEAR

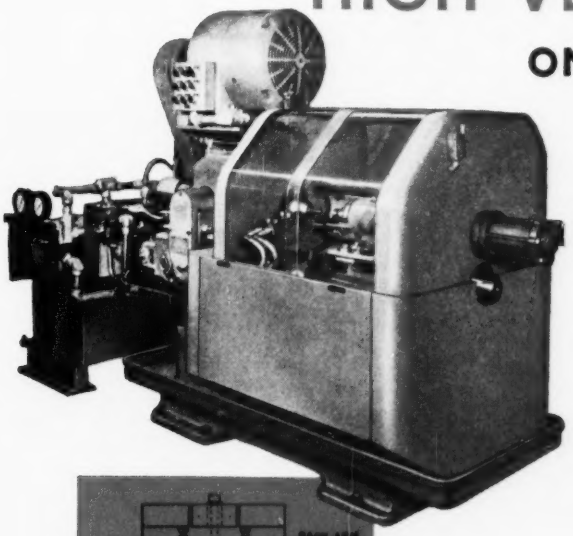
THE Van Keuren CO.,
178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires
Chrome Carbide Taper Insert Plug Gages



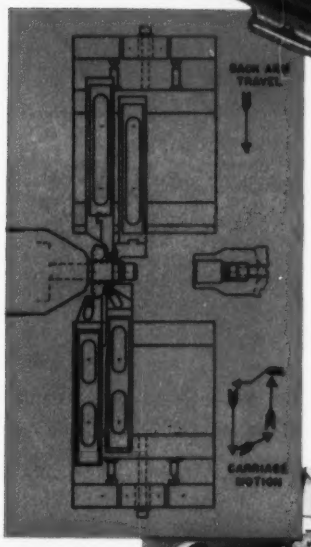
For more information on products advertised, use Inquiry Card, page 247

AUTOMATICITY BACKS UP HIGH VELOCITY TURNING ON FAY AUTOMATICS



SIDE GEARS
18 Seconds Floor to Floor — 635 SFM

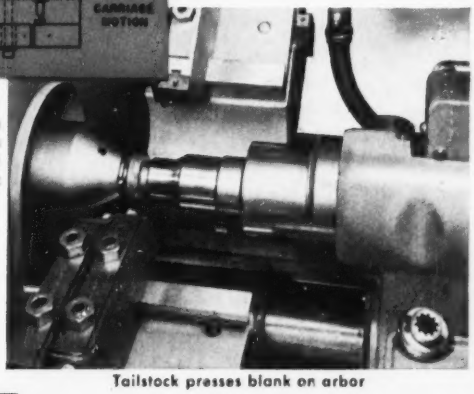
Two 8" Fays, with Automatic Sequential Control, machine all exterior surfaces of the blanks in two operations; one machine for each. The major diameter is 2-15/16" and floor to floor time is approximately 18 seconds in each operation.



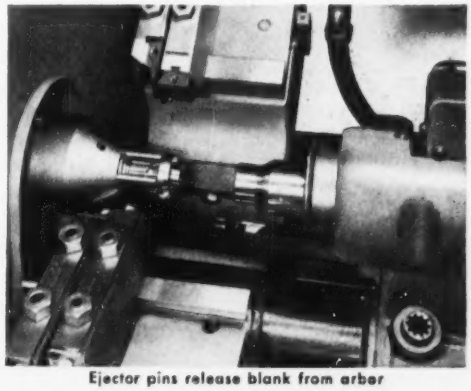
FIRST OPERATION: Note intricate movements of the carriage, which turns the hub, back angle and major diameter. The back arm faces and forms.

Automatic Cycle—The machines are equipped with automatically operated splash guards and automatically air-operated tailstock rams for pressing the blank onto a splined arbor equipped with automatically operated ejector pins.

The operator places the blank on the end of the arbor, and pushes the cycle start button. *Automatically, the guard closes, the tailstock ram presses the piece onto the arbor and then retracts. The carriage turns, the back arm faces, and at the end of the cuts, ejector pins push the piece onto the loading section of the arbor* from which it is removed manually.



Tailstock presses blank on arbor



Ejector pins release blank from arbor

Production management regularly relies upon the engineering services of Jones & Lamson for the latest information on methods, costs, tooling and performance. Why not consult us about YOUR *turning, threading and inspection problems.*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

FAY LATHE DIVISION

For more information on products advertised, use Inquiry Card, page 247

SALES and ENGINEERING SERVICE IS NEAR YOU!

There is a thoroughly qualified CLEEREMAN representative in your vicinity. Take advantage of his "know how." A study of your work may prove that the installation of CLEEREMAN equipment in your plant is the answer to your high cost and low profit problems.

Boston	General Machinery Corporation
New Haven and New York City	Giebel, Inc.
Syracuse, Rochester and Buffalo	Syracuse Supply Company
Philadelphia	Calco Machinery Company
Pittsburgh	The Motch & Merryweather Machinery Co.
Washington, D. C.	George E. Viereck & Co.
Norfolk and Charlotte	The Henry Walke Company
Atlanta	Allison Machinery Company, Inc.
Miami	R. E. Tillotson
Cleveland and Toledo	The Strong, Carlisle & Hammond Company
Dayton	The C. H. Gosiger Machinery Company
Knoxville	R. O. Deaderick Company
Birmingham	George M. Meriwether
Detroit	Production Machinery Sales Co.
Grand Rapids	Joseph Monahan Company
Indianapolis	Ernest, Holdeman & Collet, Inc.
Chicago and Milwaukee	Bryant Machinery & Engineering Company
Minneapolis and St. Paul	Bryant Machinery & Engineering Company
Duluth	W. P. & R. S. Mars Co.
Omaha	Fuchs Machinery & Supply Co.
St. Louis	Colcord-Wright Machinery & Supply Co.
Kansas City and Wichita	Ernst Machinery Company
Tulsa	Marshall Supply & Equipment Company
Houston and Dallas	C. J. Harter, Machinery
Salt Lake City and Denver	Mason Machine Tool Company
Seattle and Portland	L. C. Keir Company
San Francisco	M. A. Sherritt & Company
Los Angeles	Machinery Sales Company

CANADA:

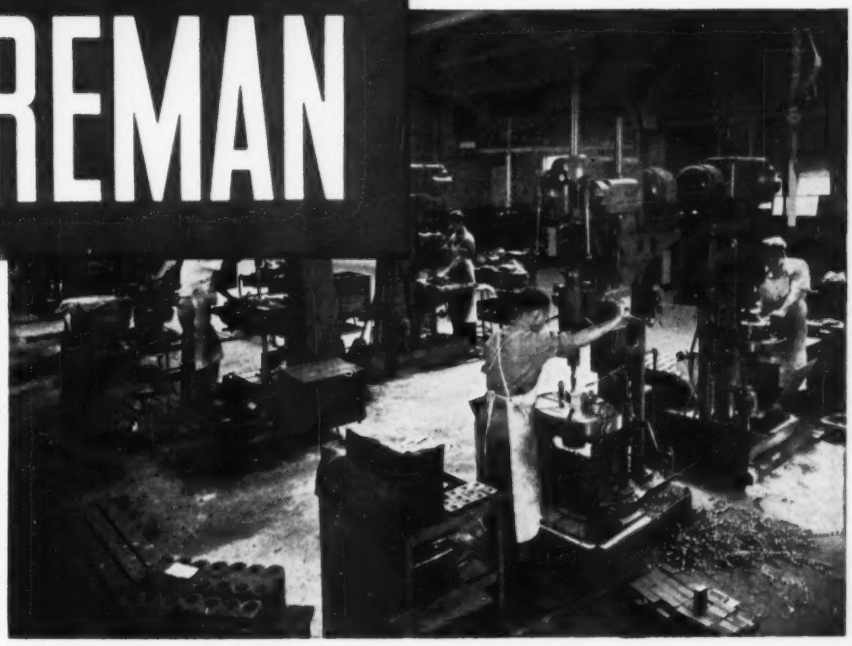
Montreal	Rudel Machinery Company, Limited
Toronto	Rudel Machinery Company, Limited
Windsor	Rudel Machinery Company, Limited
Vancouver	Rudel Machinery Company, Limited

CLEEREMAN MACHINE TOOL CO. • GREEN BAY, WISCONSIN

CLEEREMAN

DRILLING MACHINES

A battery of box column and round column Cleereman Drilling Machines on production work. One of many such installations producing at lower costs with higher production, less operator fatigue and no down time.

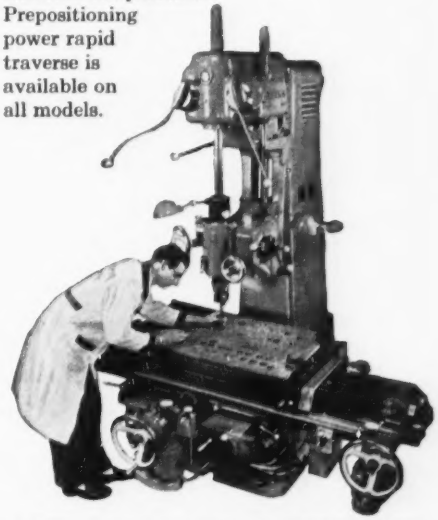


LAYOUT DRILLING MACHINE

A modern solution to an old problem. Built for those tool room and manufacturing jobs which do not require the ultra precision of Cleereman Jig Borers. The Cleereman Layout Machine is an economical machine capable of locating within .001" per foot and drilling, boring, reaming, tapping, etc., with utmost operator ease at a fast rate of production.

JIG BORER

Unexcelled precision for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work and on "jigless" production. Combines stamina with precision and ease of operation. Prepositioning power rapid traverse is available on all models.



BRYANT Machinery & Engineering Company
General Office
640 West Washington Blvd., Chicago 6
Representatives in Principal Cities

AFFILIATED WITH

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

Put the WALES Fabricator through its paces at your plant!

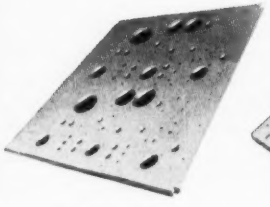
Showing *Wales Fabricator* in new mobile unit for demonstration at your plant. See it operate at your plant before you buy any other type of hole punching, notching or nibbling equipment.

Showing Wales *Trw-Edge Shear* for circle and shaped cutting, beading and forming in the new mobile unit. Material is sheared, not punched.

Above new Wales-Strippit mobile unit (1 of 3) brings the Wales Fabricator right to your plant. You and other plant executives can use this unique Wales Fabricator to produce your own parts. Your time study men can evaluate its astounding money-savings, cost-saving efficiencies.

The Wales Fabricator is the only machine of its kind and is designed for rapid interchangeability for punching, notching and nibbling. Work from blueprints or operation sheets . . . no *templates required.* Can you match the Wales Fabricator time studies below?

See for yourself. Operate it. Put it through its paces. Write today for Wales Catalog 10-AA and an appointment for a demonstration at your plant.



An electronic chassis, 12½" x 11½" with 118 holes and 4 notches was completed including setup in only 32.4 minutes and subsequent pieces in only . . . . . **6.44 MIN.**

A part of a piece of farm equipment 72⅛" x 22" with 52 holes and nibbled cut-out was finished including setup in only 12.01 minutes, subsequent pieces in only . . **2.32 MIN.**

WALES-STRIPPIT CORPORATION

GEORGE F. WALES, *Chairman*

375 **PAYNE AVE., NORTH TONAWANDA, N. Y.**

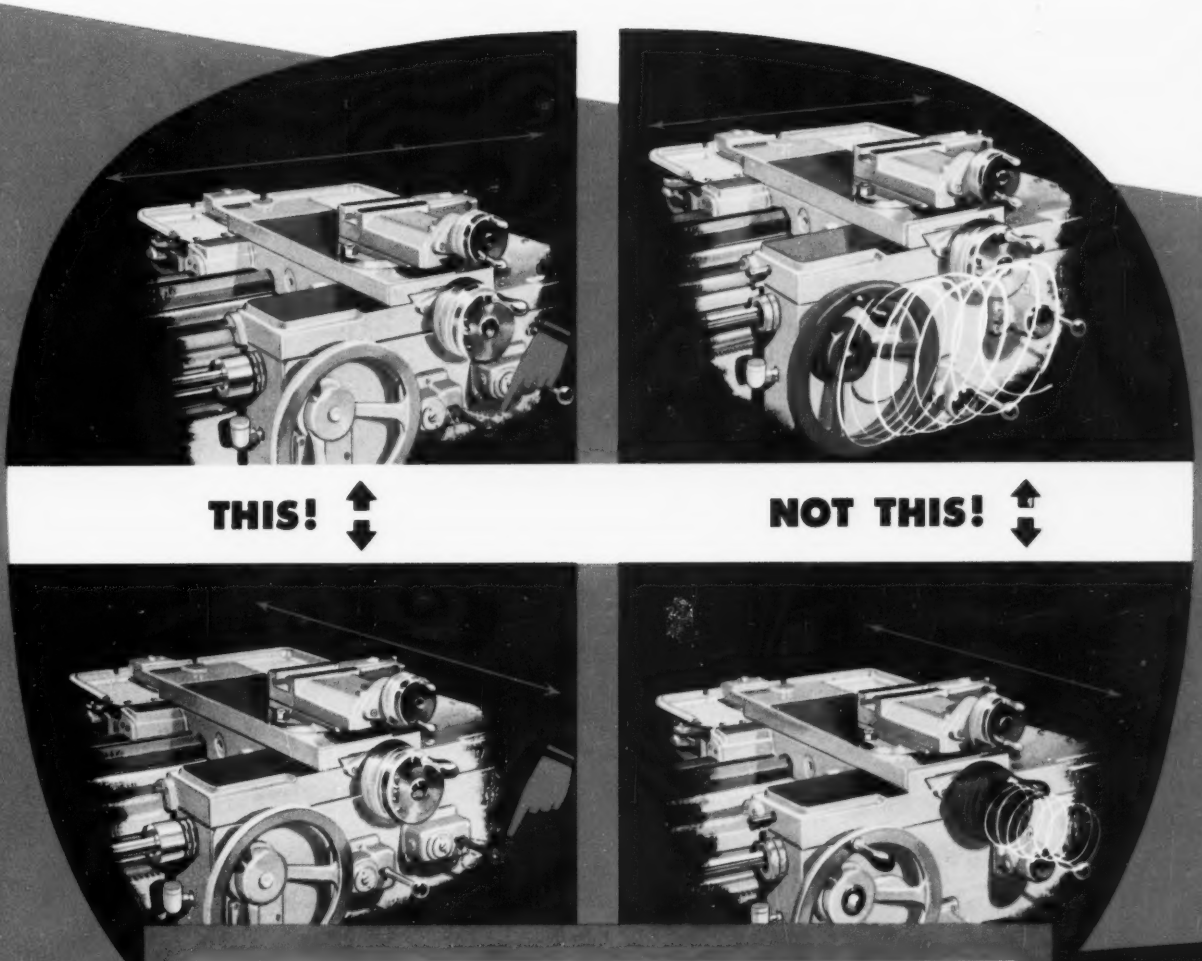
(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

For more information on products advertised, use Inquiry Card, page 247

LOOK—NO APRON STRINGS to tie lathe production down



THIS!

NOT THIS!

CUT TOOL ADJUST TIME

50%

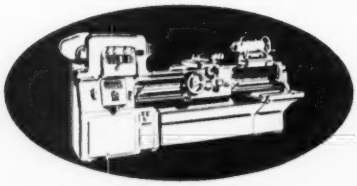
. . . Why tie Production down—when with just 2 Fingertip Apron Feed Levers, you can get Rapid Tool Positioning—Quick Tool Retraction—Fast Carriage Return—Improved Operating Ease—Greater Productivity.

SEE next 3 pages for details of the great new MONARCH Series 61 Lathes.

ANOTHER FIRST FROM MONARCH MACHINE TOOL COMPANY

FASTER PRODUCTION

The Great NEW Monarch Series 61 Lathe—with Fingertip 4-Way Power Rapid Traverse

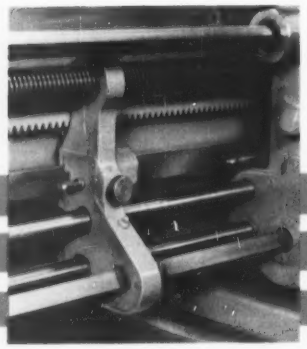


Here's a lathe to warm an operator's heart. And why not? He expends much less effort; yet produces more. The Series 61 is a machine he goes for . . . in a big way.

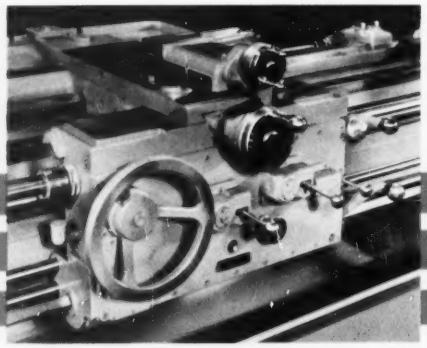
Monarch has scored another FIRST by putting *all* tool movements under power, right at the apron. This indeed is the control center of the machine. Close to it the operator spends 90 to 95% of his time. Nothing could be more logical than making it possible for him to do a better job easier at this critical position.

In addition to the Series 61 four-way power rapid traverse which slashes tool adjust time 50%, this machine includes such typical Monarch production features as **(1)** totally enclosed gear box and end gearing, **(2)** automatic pressure lubrication, **(3)** anti-friction bearings by the score, **(4)** ground or shaved helical gears in headstock, **(5)** American standard Camlock spindle nose, **(6)** flame hardened and precision ground integral bed ways and **(7)** all critical parts made of hardened alloy steel.

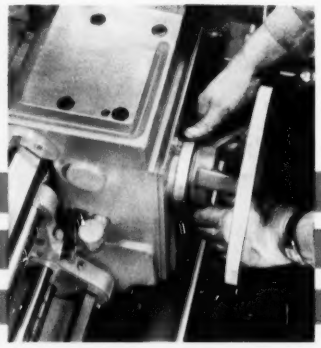
The foregoing numbered features are time-proved in the field, having won their spurs on other models of Monarch lathes. They are your guarantee that the Series 61 lathes are unequaled for accuracy, versatility and dependability. Want more information? Send the coupon (second page following) for our complete Series 61 Brochure #1124 . . . . . *The Monarch Machine Tool Company, Sidney, Ohio*



BRIGHT IDEA! Long bed Series 61 models boast these unique new traveling rod supports for leadscrew, feed rod, traverse rod and control rod. Without attention on part of operator, they're carried along—then re-positioned — as carriage travels.

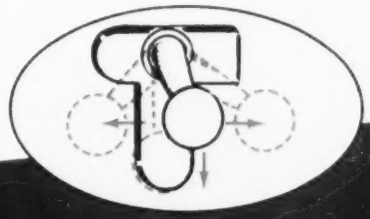


INSTANT, EASY CONTROL! Movement of longitudinal friction lever right or left actuates instant rapid traverse in direction of movement. Downward motion engages feed. Cross feed friction lever gives similar action to cross-slide. Quick —easy—a great time-saver.

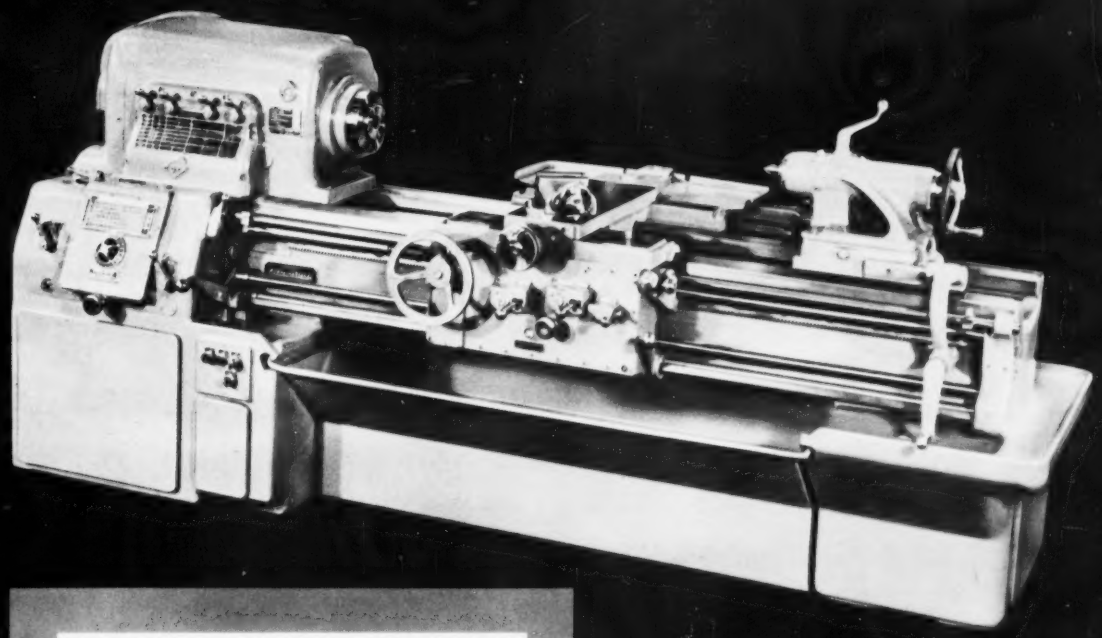


BUILT-IN DIRECT LENGTH READING DIAL! Usually furnished as an accessory at extra cost, the direct length reading dial is a built-in feature of the Series 61 and contributes to its accuracy and speed. This feature, used for multiple diameter turning or boring is especially valuable when boring blind holes.

EASIER OPERATION



CUTS TOOL ADJUST TIME **50%**



Monarch 16" Series 61 Lathe . . . representative of *the first and only complete line of lathes with inbuilt power rapid traverse.* Available in Engine and Toolmaker's Models — 13", 16", 20" and plus-swings in all three sizes.

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER — TURN TO MONARCH

Continued on next page →

Continued from preceding page

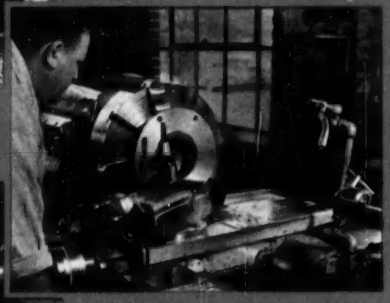
50% LESS TOOL ADJUST TIME

A BIG SAVINGS ON JOBS LIKE THESE

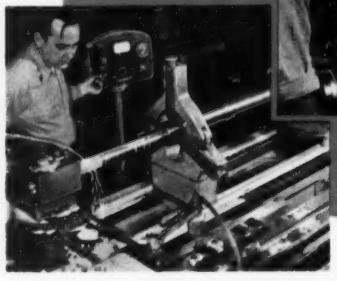
The more intricate the job, the more you save with the four-way power rapid traverse of the new Monarch Series 61 Lathes (see preceding pages). With a two-way longitudinal movement of 160″ per minute—and a two-way cross movement of 75″ per minute—you can see that the more tool adjust time needed for jobs on older lathes, the greater the savings on floor-to-floor time on the Series 61.

For further time-saving on both small lot runs and high production work, the Series 61 can be equipped with any one of 3 Monarch tracer controls—the Air-Gage Tracer, Monarch-Keller and Motor-Trace. Here's a machine with possibilities no lathe user can afford to ignore. Send coupon today for your copy of our Series 61 Brochure #1124.

TURNING



FACING



BORING

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

TOOLMAKER'S LATHES — 10″ to 20″

ENGINE LATHES — 10″ to 32″

THE MONA-MATIC
for high production metal turning

THE SPEEDI-MATIC
a fast, precision hand screw machine

THE MONARCH MOTOR-TRACE

THE MONARCH-KELLER TURNING MACHINE

THE MONARCH AIR-GAGE TRACER

THE MONARCH ROLL TURNING LATHES

THE SHAPEMASTER ENGRAVER

SPECIAL TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

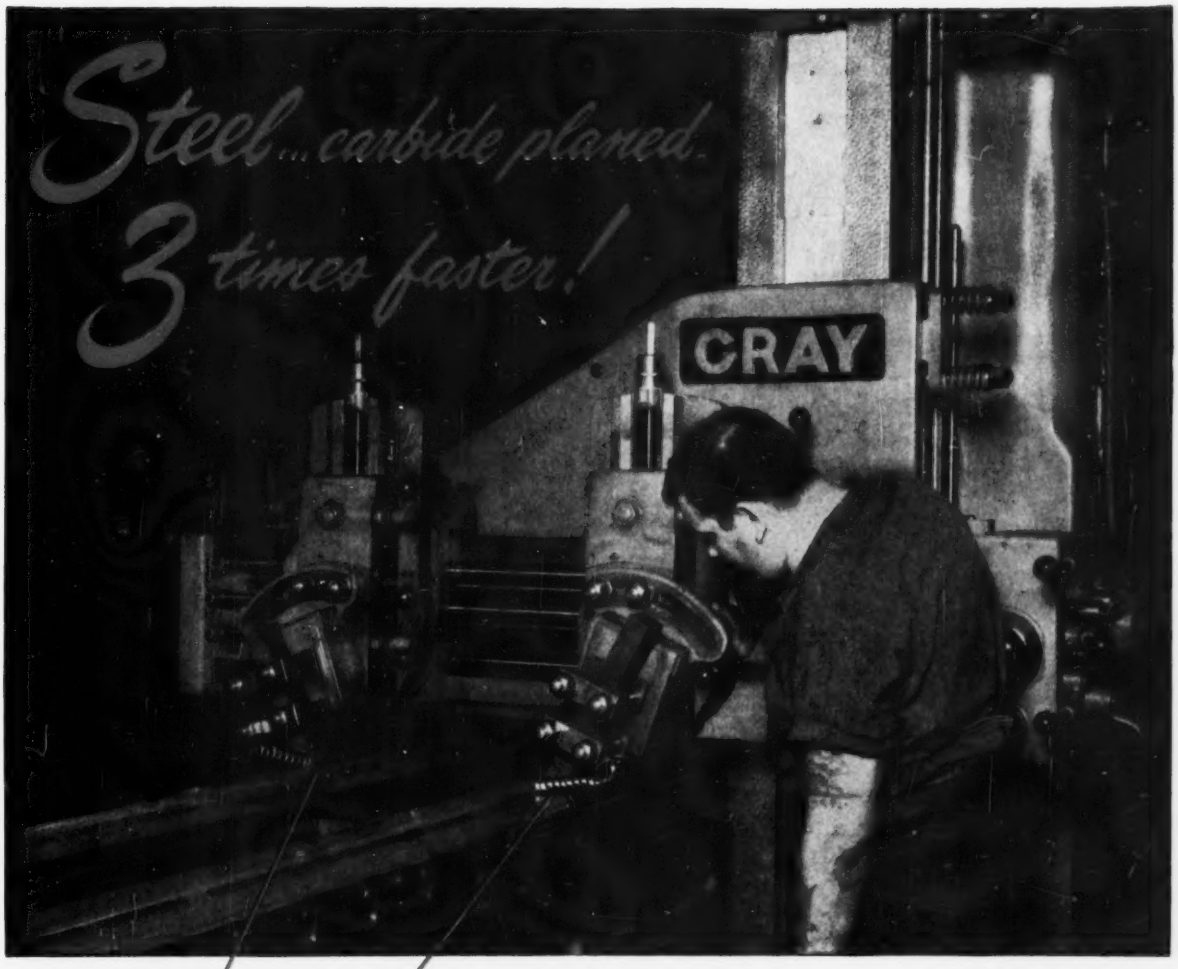
Gentlemen:
Please send me without obligation your complete illustrated Series 61 Brochure #1124

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



another cost saving performance record set by the GRAY PLANER CUB

Former planing time of steel bars and gibs was cut to ⅓ when this high speed GRAY PLANER CUB was put into action at a leading Midwestern metal fabricating plant.

This is accomplished by the Cub's high speed, greater power and tremendous rigidity—all essential to heavy duty carbide steel planing.

Proof of outstanding performance is the fact that this company has two more Cubs on order. Built in 24" — 30" — 36" sizes. Write for Bulletin 55.

the job: planing hi-carbon, hi-chrome steel bars

cut speed 160' per min. • return speed 300' per min. • two heads • depth of cut 3/32" • feed .040

The G.A. **GRAY** Company

planers • milling planers
planer type milling machines
horizontal boring machines

DEPT. B

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

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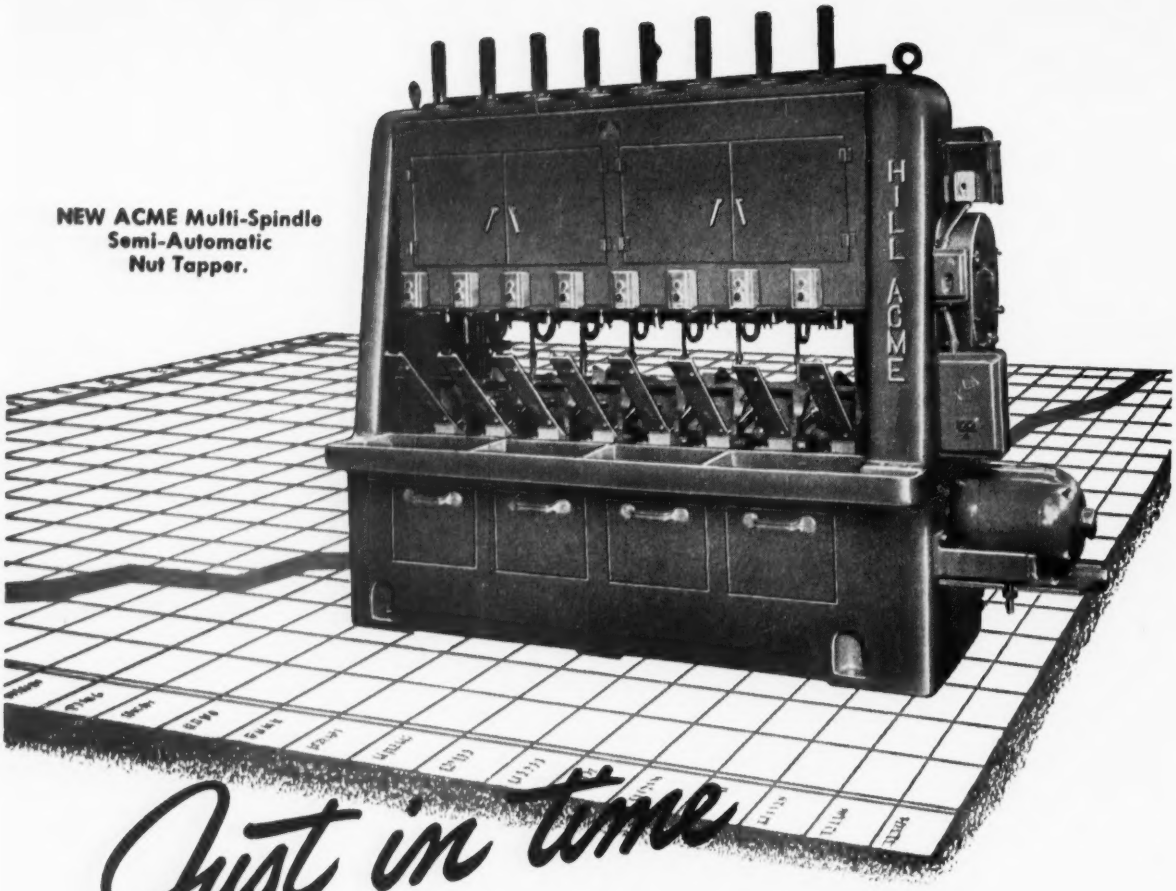

NEW ACME Multi-Spindle Semi-Automatic Nut Tapper.

Just in time

TO HELP YOU INCREASE PRODUCTION

Redesigned just in time to meet the needs of increased production in your plant, this ACME Model XWT eight spindle nut tapper will not only step up production but because of semi-automatic operation, will greatly reduce operator fatigue. Built in 6 and 8 spindle models in 1″ and 2″ capacities. The same machine can also be adapted for tapping couplings. Delivery schedules are reasonable.

FEATURES

1. Conveniently located push buttons operate the spindles.
2. Hydraulically controlled spindle cycle.
3. Repeat cycle is automatic.
4. Adjustments for change of cycle are quick and easy.
5. Change gears running in oil bath easily replaced for different spindle speeds.
6. Silent operation.
7. Worm drive in spindles.
8. Anti-friction bearings.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **1203 W. 65th St., Cleveland 2, Ohio**
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

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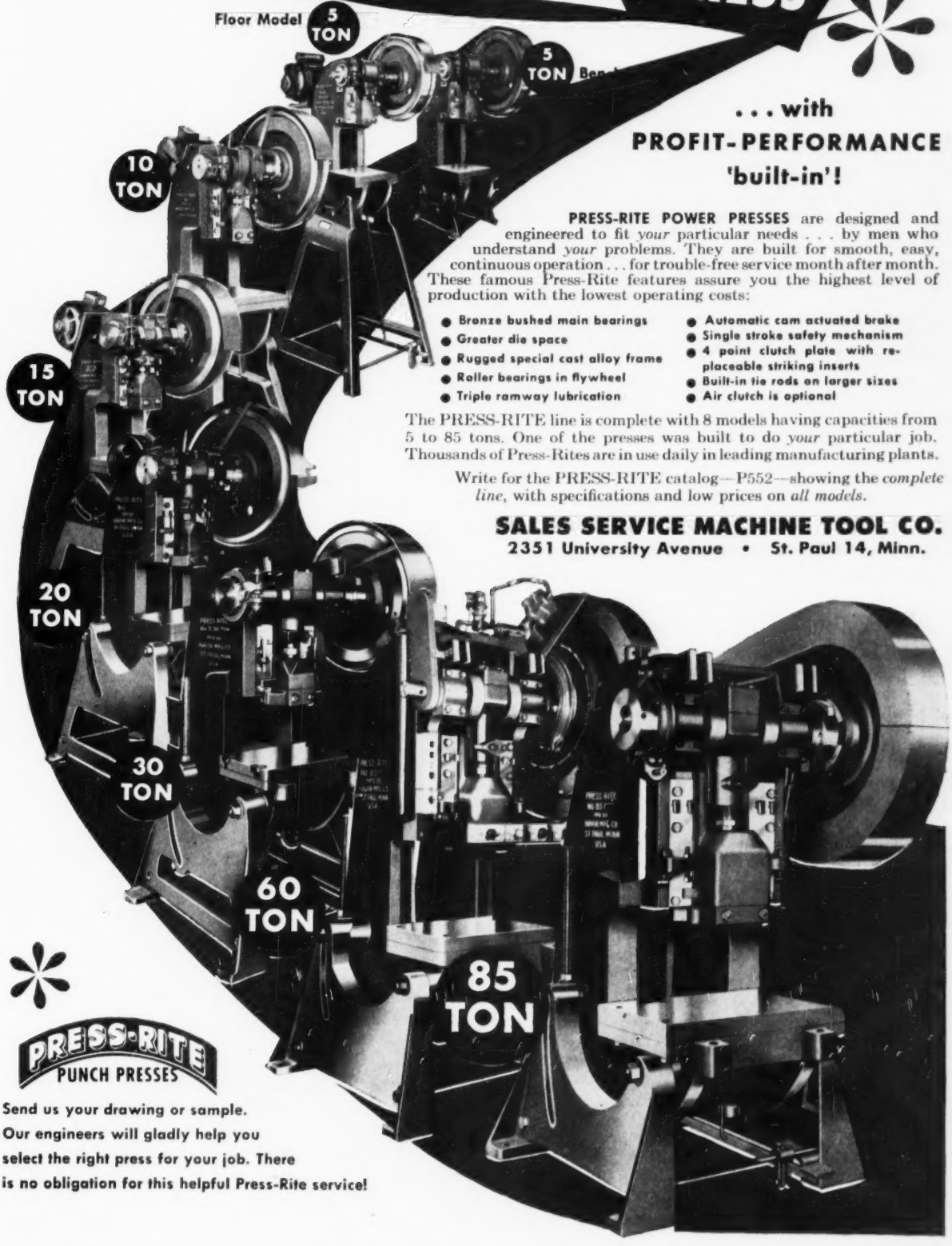
SELECT THE RIGHT PRESS



. . . with PROFIT-PERFORMANCE 'built-in'!

PRESS-RITE POWER PRESSES are designed and engineered to fit *your* particular needs . . . by men who understand *your* problems. They are built for smooth, easy, continuous operation . . . for trouble-free service month after month. These famous Press-Rite features assure you the highest level of production with the lowest operating costs:

- Bronze bushed main bearings
- Greater die space
- Rugged special cast alloy frame
- Roller bearings in flywheel
- Triple ramway lubrication
- Automatic cam actuated brake
- Single stroke safety mechanism
- 4 point clutch plate with replaceable striking inserts
- Built-in tie rods on larger sizes
- Air clutch is optional

The PRESS-RITE line is complete with 8 models having capacities from 5 to 85 tons. One of the presses was built to do *your* particular job. Thousands of Press-Rites are in use daily in leading manufacturing plants.

Write for the PRESS-RITE catalog—P552—showing the *complete line*, with specifications and low prices on *all models*.

SALES SERVICE MACHINE TOOL CO.
2351 University Avenue • St. Paul 14, Minn.

PRESS-RITE PUNCH PRESSES

Send us your drawing or sample. Our engineers will gladly help you select the right press for your job. There is no obligation for this helpful Press-Rite service!

NO GETTING AROUND IT!

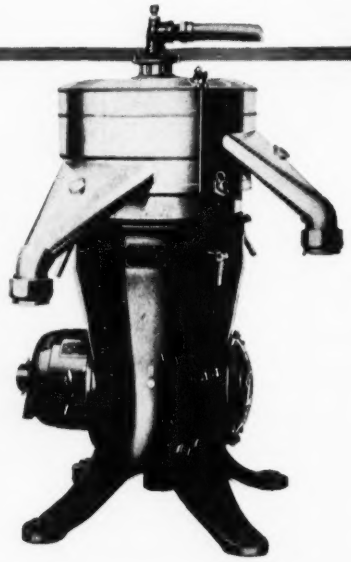
In All These 18 Applications De Laval Purification Pays Off!

Almost every metalworking plant has one or more operations where an adequate supply of clean, dry oil is a virtual necessity. 18 such applications are suggested in the panel and in every case a De Laval Oil Purifier provides the quickest, low-cost method of keeping these oils ***clean*** and ***dry***.

Clean oil is the prime requisite in most cases. Because of the greater intensity of centrifugal force, De Laval machines are more thorough than any other means. They remove every bit of dirt, abrasive or metallic particles. Thus, cutting oil can be used safely over and over again, with increased tool life and possibly less dermatitis among the men. Dies last longer when drawing oil is centrifuged; tests are more reliable when testing oil is purified.

Dryness can be a most vital consideration, as in the case of slushing compound purification. Here, too, De Lavals do the best work, quickest and most thoroughly. Water removed from the oil is continuously discharged—cannot possibly lead to recontamination.

MOTOR BLOCK TEST OIL
BALER OIL • BORING OIL
BRIQUETTING OIL • CABLE OIL
CUTTING OIL • DRAWING OIL
GRINDING COOLANT
ENGINE OIL • HONING OIL
HYDRAULIC OIL • RECOIL OIL
LUBRICATING OIL
SHOCK ABSORBER OIL
QUENCHING OIL
SLUSHING OIL
TRANSMISSION OIL
WASHING OIL



DE LAVAL

PURIFIERS AND CLARIFIERS FOR FACTORY OILS

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

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There are lots of ways to

PIERCE METALS

...But here's

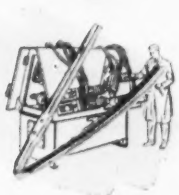
Precision Multiple Piercing at Lower Cost

DANLY HYDRAULIC METALWORKING EQUIPMENT

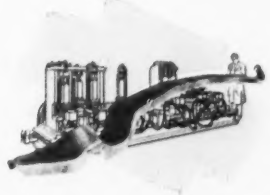
Pierce metal faster, with greater accuracy and at less cost. In a single setup for multiple piercing . . . or riveting, punch extruding or trimming . . . you can reduce costly handling by combining operations into a single setup. Danly Hydraulic Metalworking Equipment is engineered to meet your specific needs. Exclusive all-hydraulic action permits smooth operation, minimizes break-through shock, automatically strips each station and simplifies fixturing. Find out more about high production multiple hole piercing in a single setup—write today for special Danly Hydraulic Metalworking Equipment Bulletin.

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue • Chicago 50, Illinois



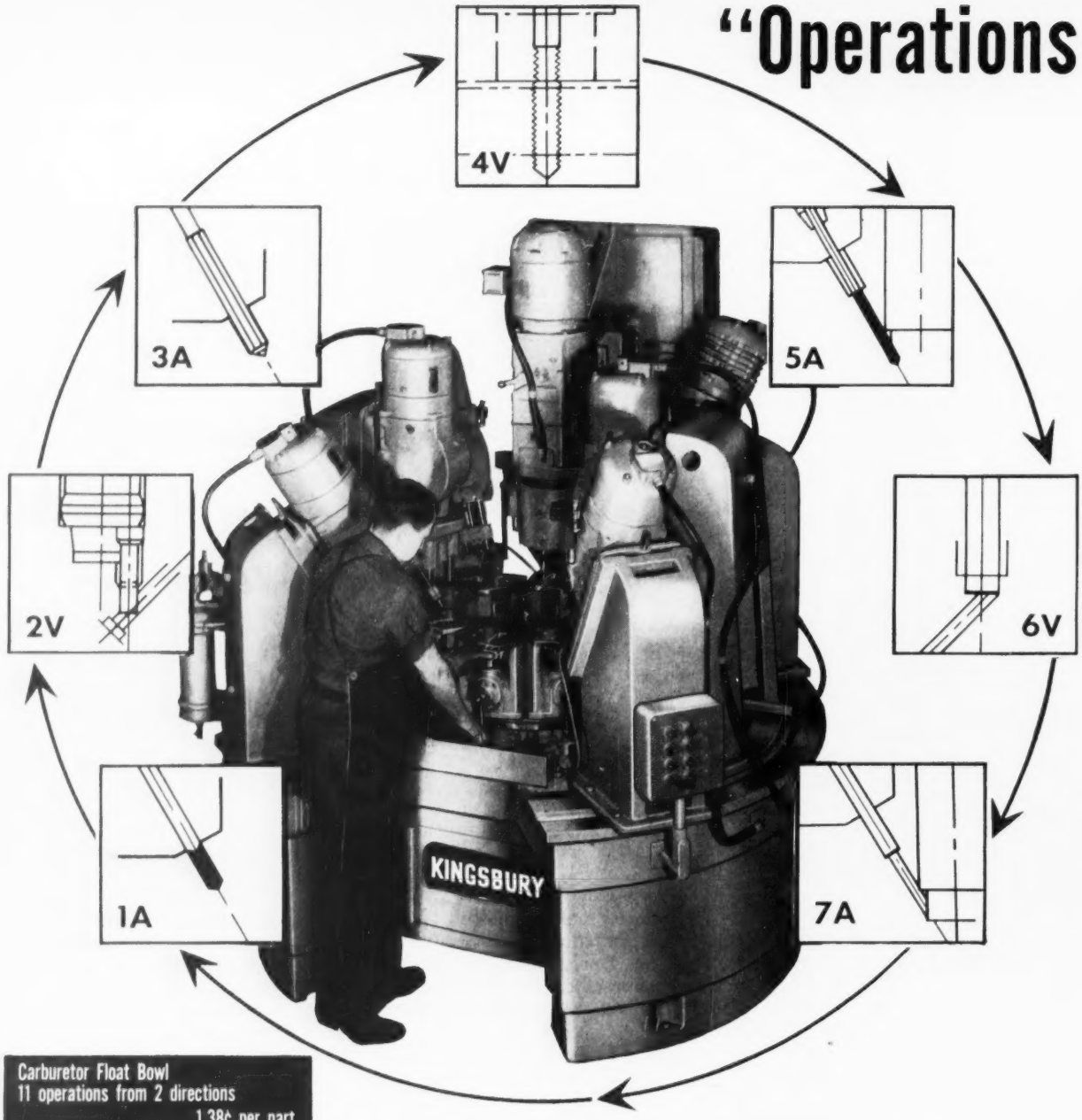
One setup pierces seven irregular holes and trims this car door inner window frame.

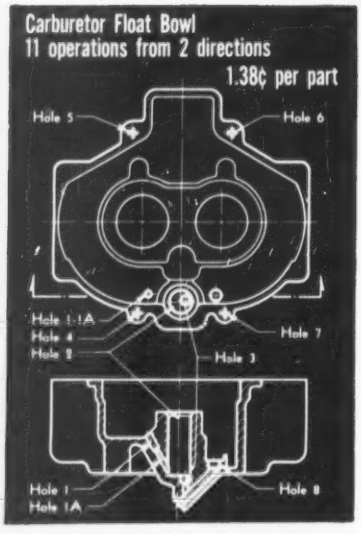


40 holes are pierced simultaneously in this automotive frame member on a Danly machine.

Irregular holes are pierced fast and accurately in this stainless steel jet engine part.

"Operations





Watch this Kingsbury drill, ream,

. . . at the rate of 55.9 operations every minute!

It works on a Carburetor Float Bowl (zinc-alloy die casting) operating on 7 vertical and 2 angular holes. It produces 305 parts per hour gross, at a cost of 1.38c per part.

This Kingsbury machine was custom-built to do a high production — low cost job on this particular piece. Four angle (A) and three vertical (V) units, operating 10 spindles, are mounted on a 60 inch base. Eight work fixtures (one for unloading and loading) are mounted on a 30 inch index turret, which indexes through the seven work stations in approximately 44 seconds. During this cycle the machine performs 11 precision operations, including broaching.

Let's follow through a work cycle — and remember this can go on day after day, year after year, producing accurate parts at low cost.

Kingsbury" all count up for profit

Let's look at these four machines

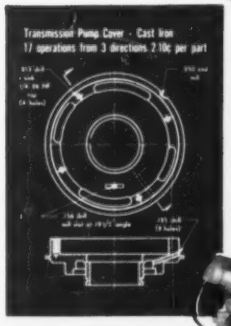
Combining operations makes it possible to perform more work in a given period of time.

On a Kingsbury Machine the tools at each station perform one or more of the required operations within a set time interval. The object is to perform all required work on the piece in one chucking within one cycle through the machine.

A single piece may be worked upon by different tools from several directions simultaneously. Everything except loading and unloading is controlled automatically — the machine takes over completely, carrying the work from station to station until the part is finished to specifications.

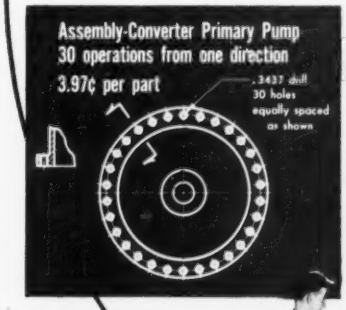
You save — because one machine does the work of several, with one operator, one chucking . . . and a high standard of accuracy that practically eliminates scrap loss. *You gain* through greater and more uniform output.

Kingsbury Machine Tool Corp.
104 Laurel Street, Keene, N. H.



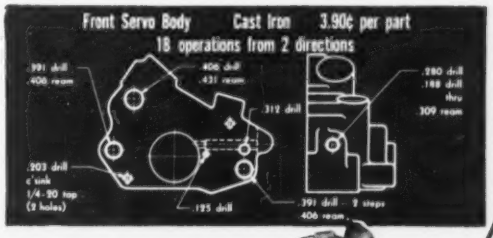
148.3 operations per minute

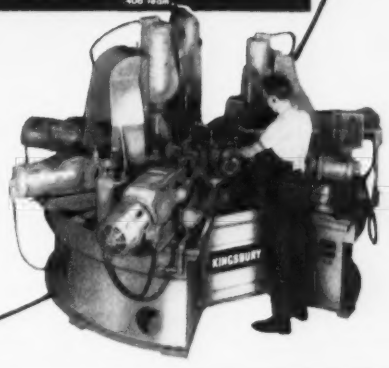
The machine drills, mills, end-mills, c'sinks and taps, at seven operational points. Seventeen tools function at six Kingsbury Units, mounted on a 60 inch base. The 30 inch index turret has eight work fixtures. Gross production 370 parts per hour.



51.0 operations per minute

The machine drills equally-spaced holes in a bolt circle slightly over 12 inches diameter. One vertical Kingsbury Unit with multiple spindle head operates 6 drills. The work fixture indexes five times to produce 30 holes — then moves to free the work for unloading and loading. Gross production 102 parts per hour.





63.3 operations per minute

The machine drills, reams, c'sinks and taps at eight operational points. Eighteen tools function at seven Kingsbury Units mounted on a 100 inch base. The 20 inch index turret has eight work fixtures. Gross production 211 parts per hour.

seat, burnish, broach and tap

Unit 1A .136 drills Hole 1 at 60° angle, 7/8 inch deep.

Unit 2V operates on cored Holes 2 and 3. It has a combination burnishing and broaching tool attached to the quill of the drill head. Spindle is eliminated. Feed mechanism of drill head forces tool downward. It .625 burnishes Hole 2 to a depth of 1 inch and .125 broaches Hole 3 to a depth of 3/8 inch. Hole 3 is located .1875 off center line of Hole 2.

Unit 3A .1375 reams Hole 1.

Unit 4V has a four spindle auxiliary drill head; taps Holes 4, 5, 6, 7 (10-32 NF Taps).

Unit 5A .057 drills Hole 1-A at same 60° angle, 5/8 inch deep.

Unit 6V .250 burrs intersecting hole at bottom of Hole 8.

Unit 7V .136 burrs flat bottom seat in Hole 1.

One operator loads and unloads.

Each Unit Cost on the drawings includes the cost of the man and of the machine — no power or overhead. We assumed:

Unit cost of man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross x 80\% eff.}}$$

Unit cost of machine to be:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hrs. @ 80\% eff.}}$$

KINGSBURY

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

Series No. 4B12 Steelweld Shear. With more than a half century of experience in steel warehousing, Enos & Sanderson know what good shearing is. They are proud of this machine. They advertise that: "Trained shearing teams will give you the finest edge ever cut with this Steelweld"

"NEVER SEEN A *SMOOTHER* OPERATING SHEAR"

Steel Warehouse Elated with Steelweld Shear

For 57 years The Enos & Sanderson Company, Buffalo, N. Y. has been supplying steel sheets and plates to hundreds of Niagara Frontier factories. Recently they installed a Steelweld Shear in their new warehouse. This is used for cutting various thicknesses to 1/4" x 12', as per customer orders. Cuts must be smooth, straight and accurate. Speed is essential to provide best service possible.

Enos & Sanderson's new 35,000 sq. ft. steel warehouse

The following paragraph in an unsolicited letter from Enos & Sanderson indicates how well their Steelweld Shear is serving their needs:

"We are extremely satisfied with the operation of this unit and would recommend this machine highly to anyone. A rigger, who set up this shear for operation, remarked that, in his twenty-five years of work with shears of all types, he had never seen a smoother operating shear in his experience."

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
5435 East 282 St., Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS

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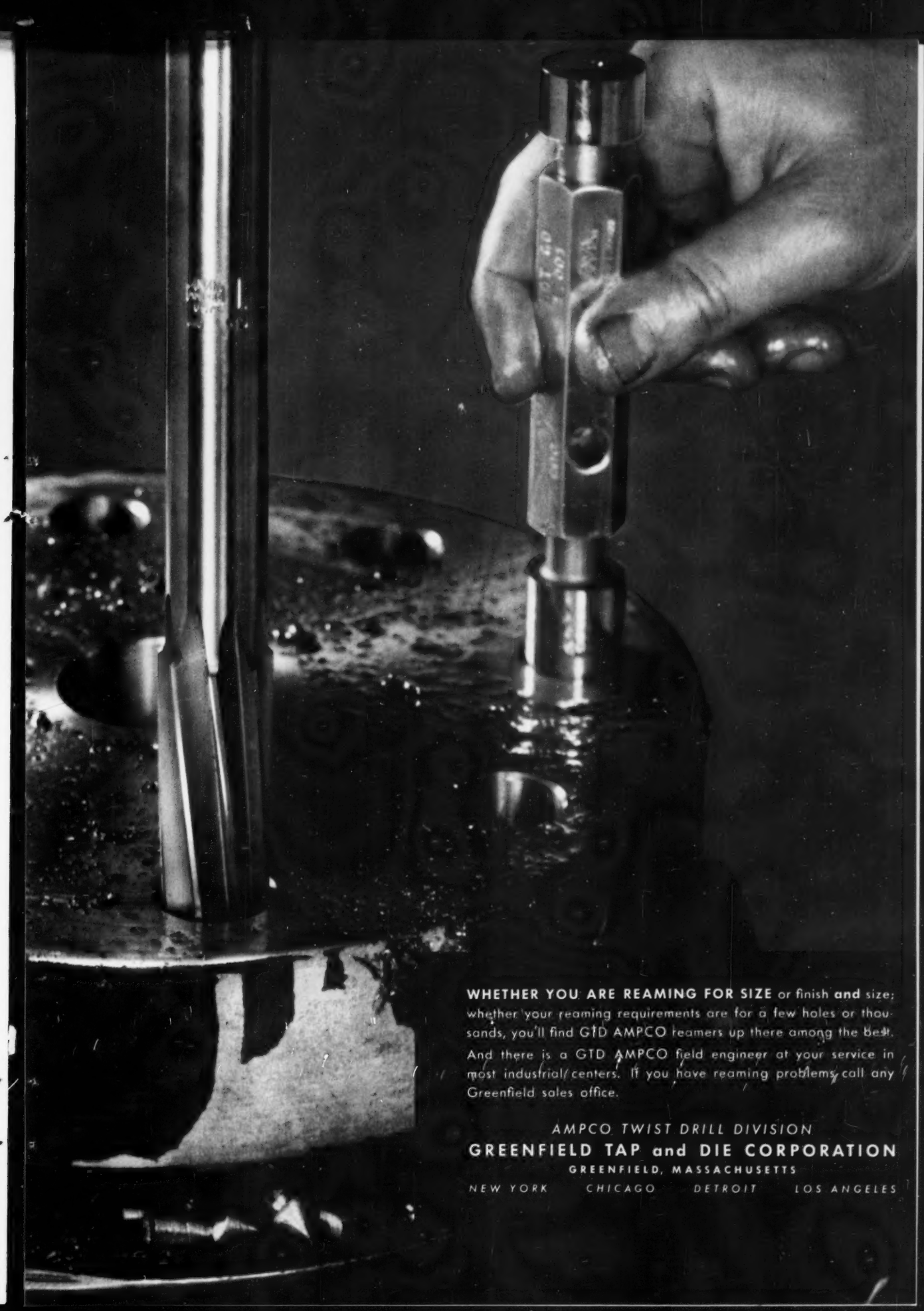

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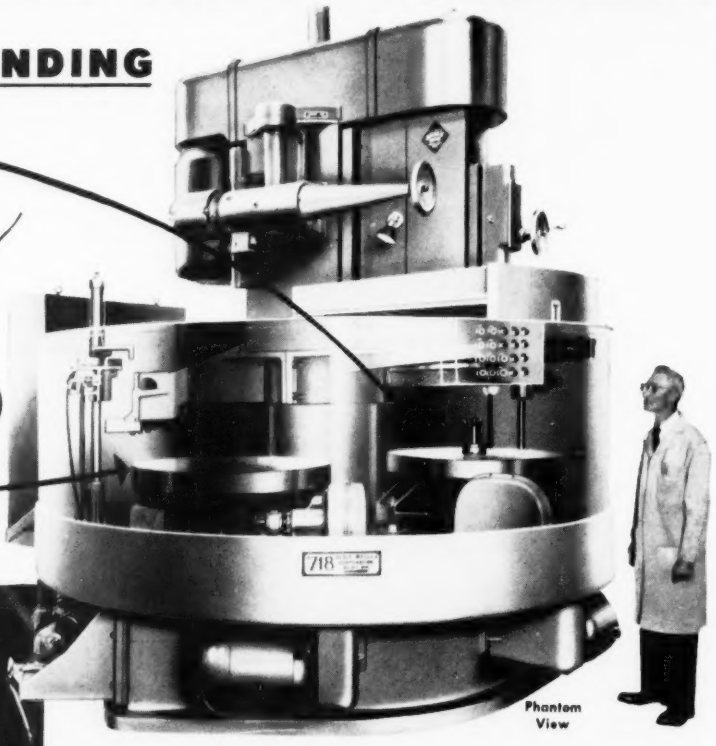
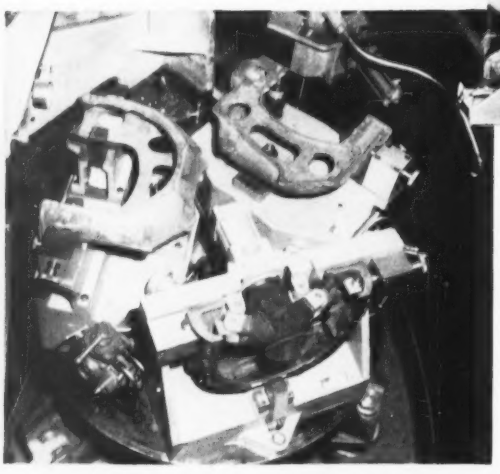
ON SEQUENCE GRINDING

The Head Swings to Grind Here

While Work is Loaded or Re-Positioned Here



Phantom View



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This high production rate is achieved grinding large automotive housings. An automatically controlled grinding cycle completely frees the single operator for loading, re-positioning and unloading duties. Accuracy is also noteworthy. With approximately 3/32-in. of stock removed from each of three faces, work is held parallel within .003-in., flat within .005-in. and to size within .010-in.

Only the BESLY-BOWEN RADIAL HEAD FACE GRINDER

Has These Cost-Cutting Features:

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- Automatic Size Control
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Write for a Full Description of This Type of Grinder and Bulletin 700

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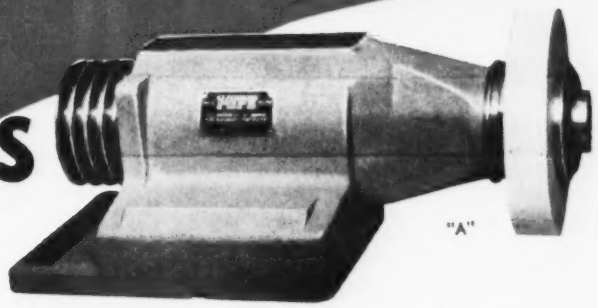
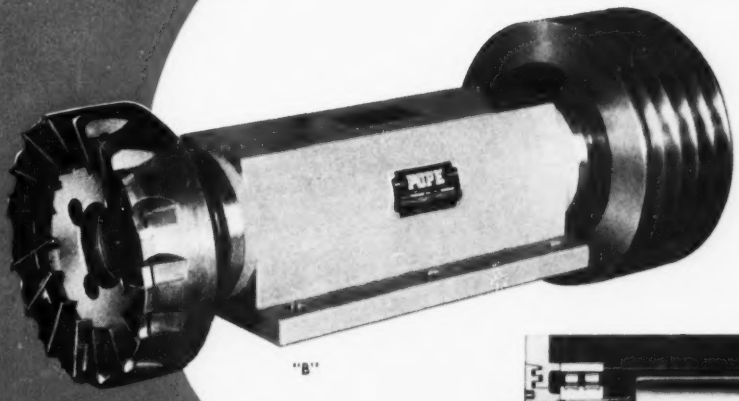
Specify POPE

HEAVY DUTY WHEEL HEADS

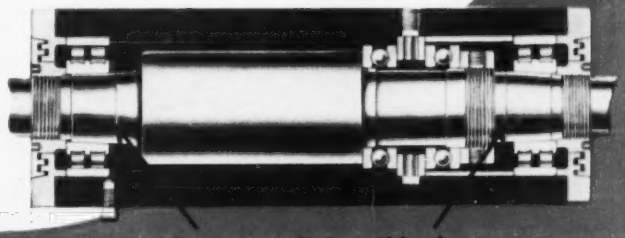




Note the big precision bearings and the big shaft.

A pair of precision thrust bearings stabilize the shaft against any axial movement in either direction. (No end play)

The double row cylindrical roller bearings carry the radial loads with ease and at low temperature.



Send us your specifications and ask for quotations.

Taper mounting provides for precise individual preloading of the radial bearings.

POPE Heavy Duty Wheel-Head Spindles are designed for a wide variety of applications such as grinding, boring, milling, drilling and many other operations requiring PRECISION COMBINED WITH RUGGEDNESS in the spindles.

For continuous production and trouble-free operation THERE'S NOTHING LIKE A POPE SPINDLE WITH ROLLER BEARINGS.

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Specify POPE® PRECISION SPINDLES

POPE MACHINERY CORPORATION
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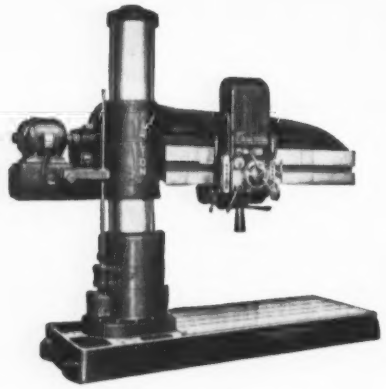
Only ONE can be called the Finest: Carlton

...here's another good reason why: low maintenance cost



CARLTON RADIAL DRILLS cost less to maintain because they are *designed for less maintenance attention.* For example: there's only *one* friction clutch to adjust. There are *no* tapered gibs to adjust because the head travels across the arm on hardened steel ways. Automatic lubrication throughout eliminates the damage and unnecessary wear that occurs in ordinary radial drills.

COMPARE CARLTON AND YOU'LL BUY CARLTON. Judge for yourself why Carlton radial drills are the first choice of American industry. Write for bulletins. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

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Production flows faster and smoother when your machine tools are equipped with Jacobs Chucks.

Rugged construction, great gripping power and accuracy have made The Jacobs Plain Bearing Drill Chuck the choice of machinists throughout the world.

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IF IT'S A JACOBS IT HOLDS

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. . . first in chucks

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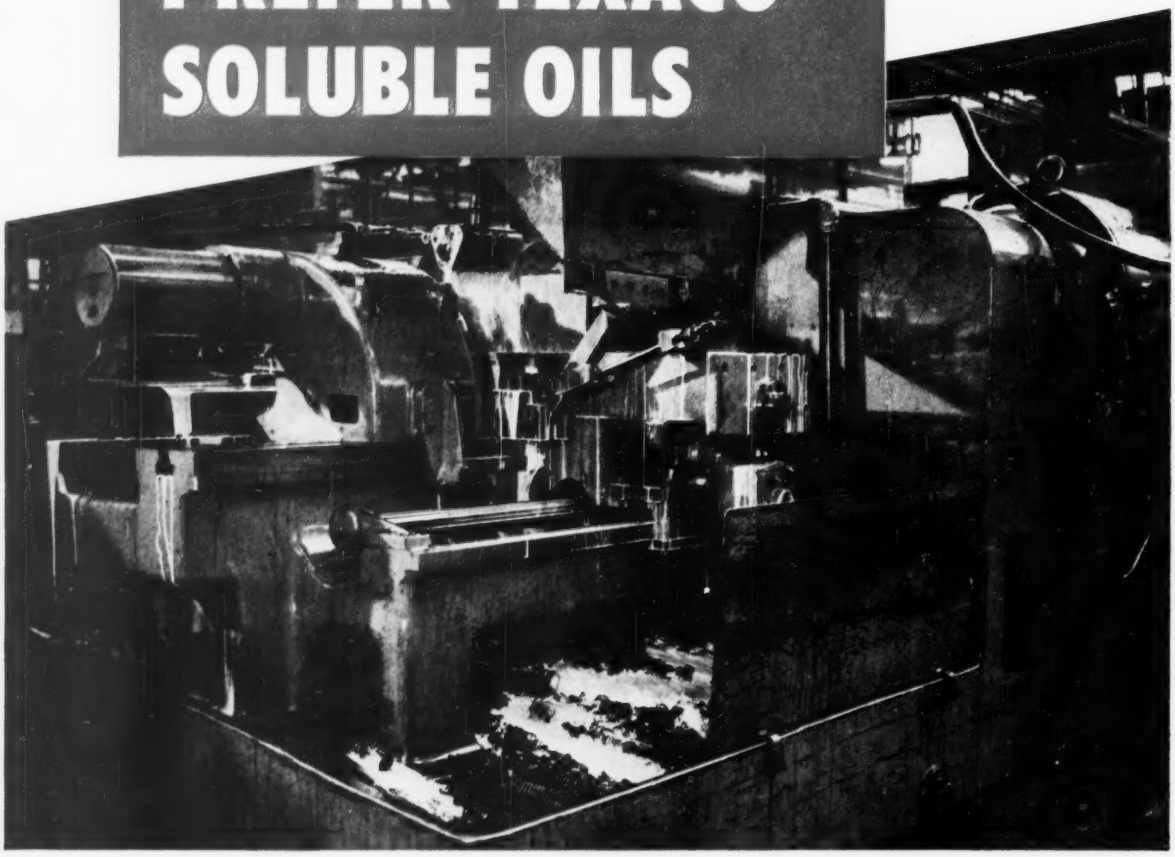

PROOF OF PERFORMANCE is the best way to point up the outstanding advantages of *Texaco Soluble Oils*. The following examples are drawn from actual case histories (names on request):

More stable emulsions: Even a two-month shutdown, when emulsions stood in tanks and lines, did not materially affect the stability of the *Texaco Soluble Oil* emulsions used in this large mid-western plant.

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Longer tool life: On a spindle grinding operation, a *Texaco Soluble Oil* emulsion doubled wheel life for this New England plant.

There is a complete line of *Texaco Cutting, Grinding, Soluble and Hydraulic Oils* to help you do *all* your machining better, faster, and at lower cost. A Texaco Lubrication Engineer will gladly help you select the right ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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By LORING F. OVERMAN

Economy the Prime Consideration

EVEN more important than the plans being announced these days in Washington is the reasoning behind them. Consider first the plans. The $12,000,000,000 cut in the President's budget, as compared with that of his predecessor—the cancellation of $140,000,000 worth of Army contracts, and the announced intention to cancel another $500,000,000 worth by June 30—the decision to hold the United States Air Force to a 137-wing program (instead of 143 wings), and completion of the program one year later than was originally planned—and the proposed reorganization of the Department of Defense to put a business checkrein on plans and expenditures.

To those who believe that prosperity must depend upon a wartime economy and heavy government expenditures, the "new look" in Washington may not be too inviting. True, a Federal budget of $65,600,000,000 isn't just peanuts, but the fact that the upward trend has been arrested by $12,000,000,000 is worthy of more than passing mention.

How Decisions are being Made

There is now the determination to analyze a second time every proposed expenditure, every new tax proposal, and every project involving collections and expenditures. In some instances, the new look involves spending less. In others, it dictates passing up a proposed tax cut in the interest of stability. In still another, stabilization of the budget has been considered less in the public interest than in a more gradual application of the economic brakes. It begins to be apparent in Washington that decisions are being weighed on two scales—"Is it good business? Is it good politics?"

IT is suspected that political considerations are being given more attention than the Administration would like, but since it is good business to keep on being elected, the President's advisors have apparently sold politics as a "must." The need to balance the political budget as well as the financial one is causing various factions considerable concern. Some people, for example, have the feeling that the program leans toward labor too much in its proposed Taft-Hartley revisions. Others feel that the proposed housing program gives considerable weight to the low-income large-vote group. Still others wonder how far Government can afford to go in social security, in health insurance underwriting, and in foreign aid.

Spending No Longer for the Mere Sake of Spending

All in all, the Administration's budget message and its other pronoucements since the first of the year indicate that Washington may have come to the end of a period of spending money just for the sake of spending, or just because it has been appropriated for some earmarked purpose. It is becoming increasingly obvious that the Administration is scanning its plans with the same caution that is demanded of successful business executives.

Take, for example, the $250,000,000 that Congress earmarked last year for machine tools and other production equipment. Secretary of Defense Wilson told newsmen recently that further spending to create productive capacity which might be needed in the event of an all-out emergency now seems unlikely. None of the $250,000,000 for production equipment has been spent, and it was his belief that of this amount not more than $100,000,000 will be used in fiscal 1954-1955.

MR. Wilson hastened to add that one of the objectives of the current plan is to keep the aircraft and machine tool industries running and ready for emergencies. He indicated that the 137-wing Air Force program would take care of the aircraft industry, but he was vague as to plans for machine tools. Unless later special provisions for that industry are announced, it must be assumed that manufacturers of production equipment will be expected to take their chances under the "improved atmospheric conditions" which the Administration is said to be planning for business. This atmosphere, Washington reports, seeks to restore to both firms and individuals the will and the inducement to produce, earn, and save.

"The economy budget," President Eisenhower observed, "marks the beginning of a movement to shift to state and local governments and to private enterprise Federal activities which can be more appropriately and more efficiently carried on in that way. In those cases where Federal participation is necessary, the effort of this Administration is to develop partnerships rather than an exclusive and often paternalistic position for the Federal Government."

New Conception of National Defense

The budget, with its emphasis on encouraging business to invest and to produce for civilian use, is obviously based on a new conception of national defense. Instead of maintaining heavily manned defense forces equipped with land material, the new plan calls for massive retaliation—the delivering of atom or hydrogen bombs by air anywhere they will be most effective.

Immediate shifts in defense dollars are called for. Aircraft and ships will not be affected. Guided missiles, together with electronics, will be favored. Reduced ground forces will trim the need for conventional vehicles and equipment. European continental defense will still demand considerable equipment of the conventional type, and Asia may make similar claims. In general, an air-patrolled peace is contemplated with considerable assurance that this less expensive plan will be much more of a deterrent to attack than former methods of defense.

ALREADY the guided missile program has reached a stage of perfection that permits the setting up of anti-aircraft defenses near our major cities; and the dispatch of air-to-air guided missile squadrons to defense posts overseas. Apparently the day of "push-button" attack and defense is so close at hand that it is sheer waste to continue the production of conventional weapons. Such a conclusion requires startling changes in planning, procedures, and expenditures.

Precision PRODUCTION MACHINES

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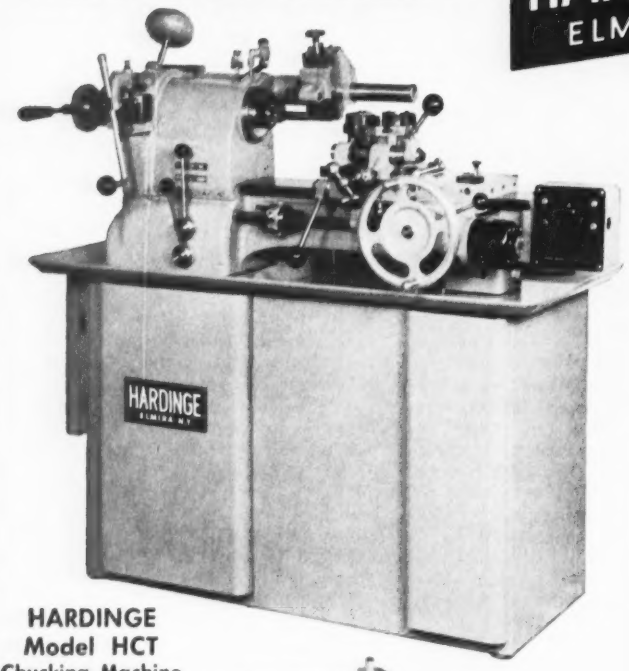
Precision TOOL ROOM MACHINES



HARDINGE
Model HCT
Chucking Machine with Production Threading Head

Also Model HC Chucking Machine without Production Threading Head

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Model DSM 59
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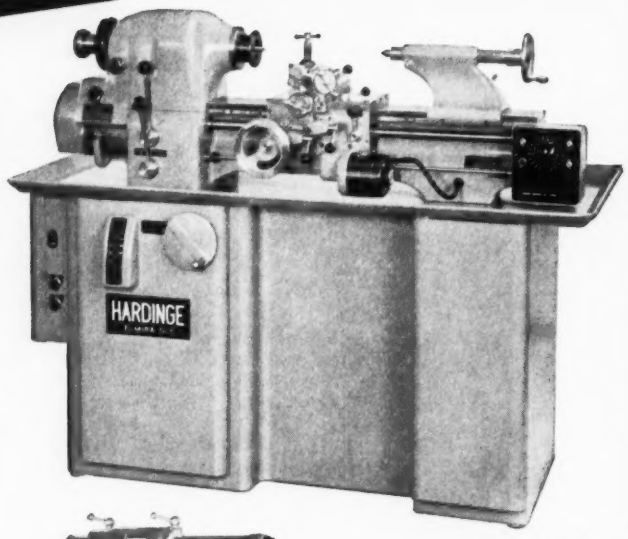

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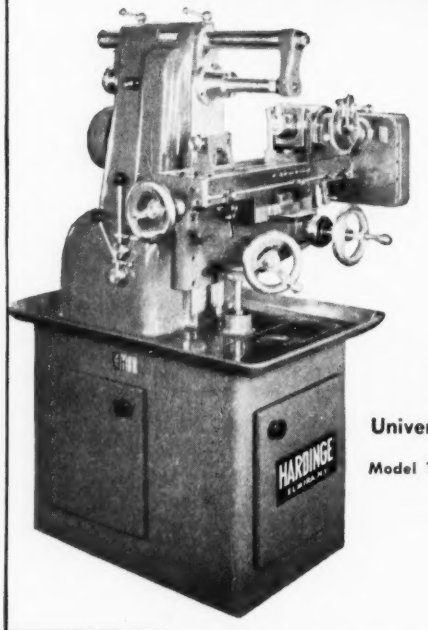
Model HLV
Tool Room Lathe



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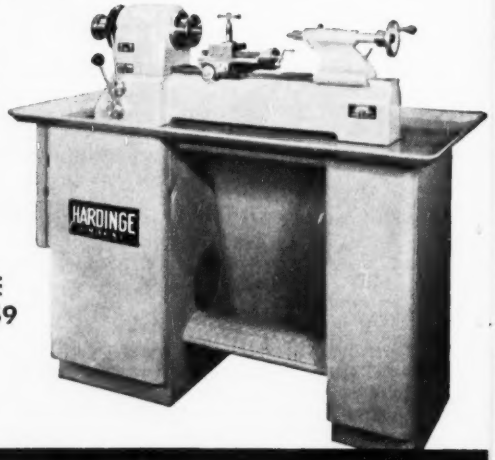

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MACHINERY
MARCH 1954

Pilot Production Lines to Avoid Machine Tool Crises

WHEN the Korean episode caught this country unawares, jet-engine airplanes were still in their infancy and there were no provisions for turning out this revolutionary type of fighting plane on a mass-production basis. At a Washington meeting where a newly developed jet engine was being exhibited for the first time to a group of manufacturers, an Air Corps officer intimated that machine tool builders had been lax in not having produced equipment suitable for machining the components peculiar to that type of engine. How could they have done so, when the jet engine had been kept a closely guarded secret until its completion?

Throughout present discussions pertaining to the disposal of machine tools accumulated by the Government as a result of its National Defense programs, little consideration has been given to the major problem existing at the beginning of any war. That problem is to obtain machine tools capable of manufacturing the weapons that have been designed since the previous conflict. As weapons, projectiles, and aircraft are changed, there must also be changes in the construction of the machine tools required to make them—but sight is often lost of this fundamental fact. The Korean emergency soon demonstrated the inadequacy of many World War II machine tools for meeting new manufacturing problems.

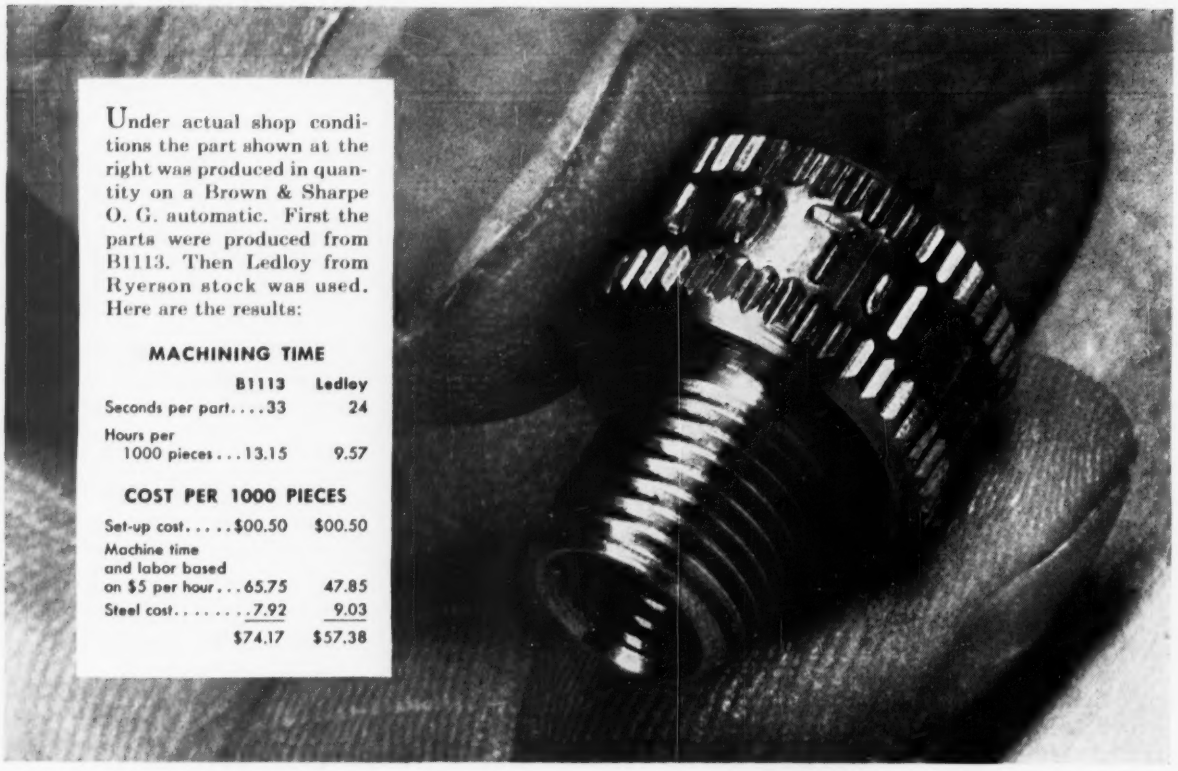
One of the machine tool experts in the United States Navy, Captain R. E. W. Harrison, has advocated in the *Journal of the American Society of Naval Engineers* the setting up of pilot production lines that would keep apace with the evolution of new weapons of warfare. It is Captain Harrison's opinion that when the Armed Services are convinced that a new weapon is necessary, funds should be obtained from Congress not only for making pilot weapons but also for establishing a pilot production line that would indicate the designs of production type machine tools which would be required to mass-produce the new weapons. While the arsenals attempted to perform this function in the past, their programs suffered from lack of funds and proper organization.

Pilot production lines of this kind should be established on a permanent basis. Machine tool builders in return for contracts of the smallest acceptable size would willingly cooperate with the Armed Forces in the development of machine tools suited to meet each new condition. Machine changes would be made in the pilot production line each time the product was substantially altered.

Such a farsighted policy would go a long way toward eliminating production bottlenecks in times of national emergency.

Charles O. Herb

EDITOR



Under actual shop conditions the part shown at the right was produced in quantity on a Brown & Sharpe O. G. automatic. First the parts were produced from B1113. Then Ledloy from Ryerson stock was used. Here are the results:

MACHINING TIME

	B1113	Ledloy
Seconds per part	.33	24
Hours per 1000 pieces	13.15	9.57

COST PER 1000 PIECES

Set-up cost	$00.50	$00.50
Machine time and labor based on $5 per hour	65.75	47.85
Steel cost	7.92	9.03
	$74.17	$57.38

$16.79 saving on 1000 parts using Ledloy from Ryerson

In shops throughout the country Ledloy is effecting similar savings—establishing its superiority over all other free-machining steels. Since switching to Ledloy, one shop reports an increase in production of 54%; another 43%; still another 75%!

On the average, this remarkable lead-lubricated steel brings net savings of 25% or more everywhere it is used by permitting much faster feeds and speeds (25 to 50% faster than B1113) and by extending tool life as much as 200%. Still Ledloy retains the strength and other good qualities of an open hearth steel. Machines to an unusually clean, smooth finish—bends, crimps, swedges or rivets easily.

You can get quick shipment of Ledloy in any quantity from your nearby Ryerson plant. Rounds, squares and hexagons are immediately available in a wide range of sizes. And your Ryerson representative will be glad to give you all the engineering data on this remarkable free-machining steel. We suggest you order a trial quantity now.

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CARBON STEEL BARS—Hot rolled & cold finished
ALLOYS—Hot rolled, cold finished, heat treated
STRUCTURALS—Channels, angles, beams, etc.
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
PLATES—Many types including Inland 4-Way Safety Plate
REINFORCING—Bars & Accessories, spirals, wire mesh
SHEETS—Hot & cold rolled, many types & coatings
BABBITT—Five types, also Ryertex plastic bearings
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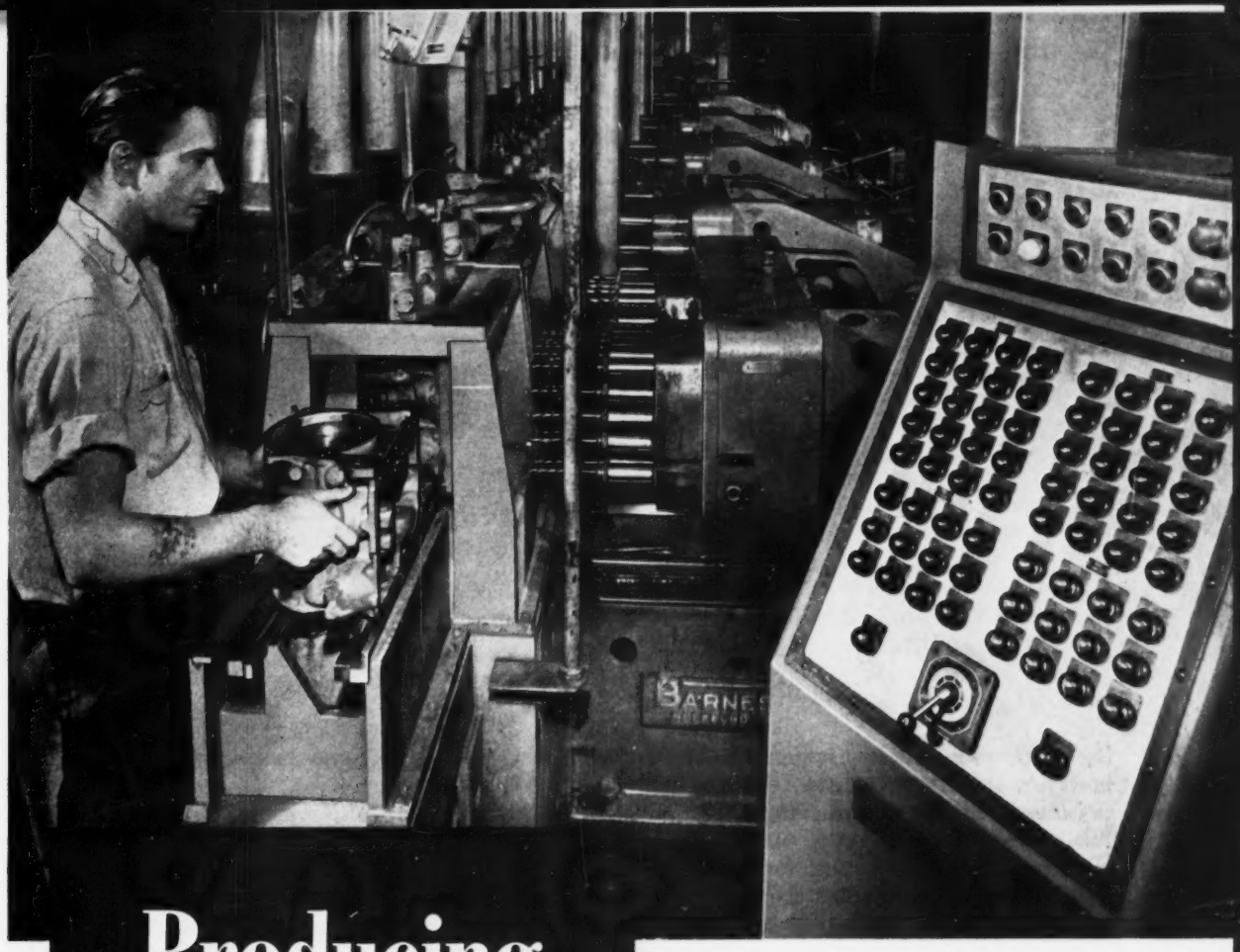


Producing Chrysler's Power Flite Transmission

By Charles H. Wick
Associate Editor

Approximately 1600 production machine tools are employed in the Indianapolis plant of the Chrysler Corporation to produce about 120 different parts for the latest automatic transmission in the industry

POWERFLITE, newest fully automatic transmission in the automotive industry, consists essentially of a torque converter and two-speed planetary transmission. Representing years of research and development work, this latest Chrysler Corporation product has an over-all torque multiplication ratio of 4.47 to 1, the highest in the industry for passenger car drive-range operation.

In operation, the torque converter, seen at the left in Fig. 1, acts simply as a hydraulic coupling for almost all level-road, constant-speed conditions. When accelerat-

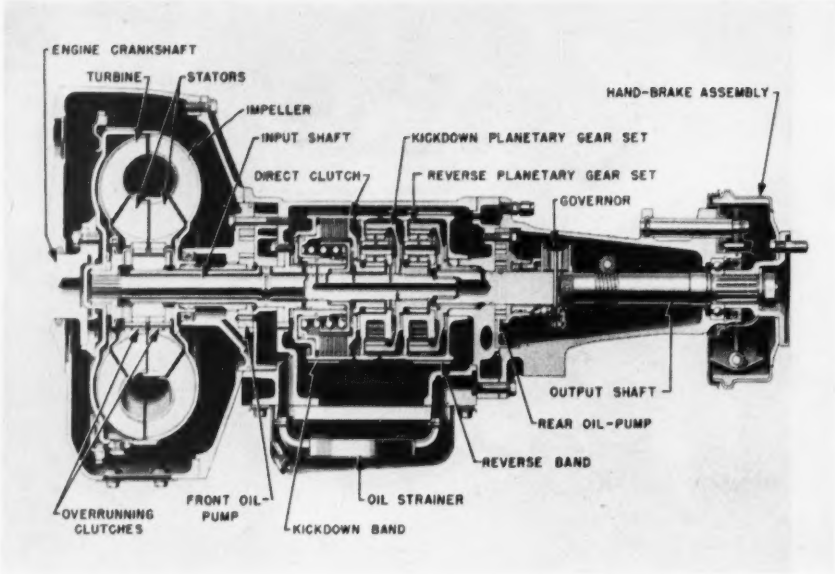


Fig. 1. Sectional view of PowerFlite automatic transmission showing the torque converter at the left and the two planetary gear sets in the center

ing or climbing hills at low or medium speeds, however, the converter automatically increases the torque to meet the driving conditions. The two hydraulically controlled planetary gear sets, shown at the center, further insure ample torque multiplication, and furnish the various shift positions required.

The hydraulic control system for the automatic transmission actuates the two brake bands and internal clutch which control the motion of various members of the planetary gear sets. Once a driving range has been selected on the steering column lever, the hydraulic control valves automatically provide the proper gear.

Approximately 120 different parts for the PowerFlite transmission are produced on about 1600 machine tools in the new Indianapolis, Ind., plant of the Chrysler Corporation. Some of the most interesting operations and machine tools employed will be described in this and a subsequent article.

Transmission cases are made from a high-

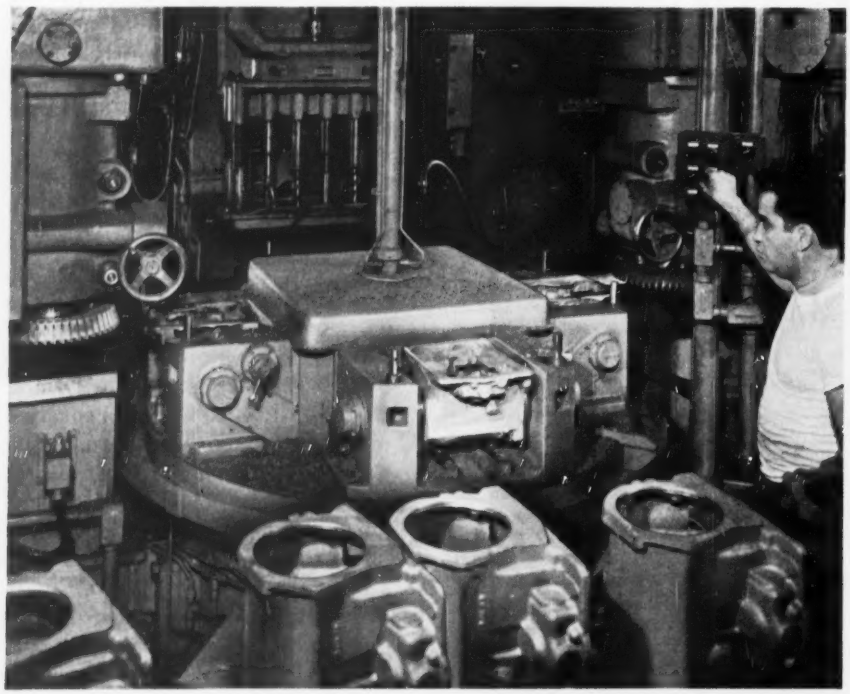


Fig. 2. Four-station rotary indexing machine for rough- and finish-milling oil-pan face, and chamfering, drilling, and reaming two holes

strength cast iron having a Brinell hardness between 149 and 187. Locating holes and the oil-pan face on the casting are cut on the special Fitchburg four-station, vertical milling and drilling machine seen in Fig. 2. The rotary indexing table on this machine is equipped with four work-holding fixtures. At the first station, the case is loaded with its oil-pan face up, locating from two rough-machined bores and three cast bosses.

When the casting has been indexed to the second station, its oil-pan face is rough-milled by means of a 15-inch diameter, insert type cutter having fifty-two tungsten-carbide blades. About 1/64 inch of stock is left on the oil-pan face for subsequent removal in finish-grinding. Two 5/8-inch diameter locating holes (required in the oil-pan surface for manufacturing purposes) are drilled, chamfered, and reamed at the third station. This is accomplished by means of a four-spindle head that makes two passes before the work-piece is indexed to the next station. Carbide-tipped, combination reaming and chamfering tools are provided on two of the spindles. At the fourth station, the oil-pan face is finish-milled, again using a 15-inch diameter cutter with the same number of blades. The transmission case is unloaded from the fixture after it has been returned to the first station.

All holes in the front and rear ends of the cases are drilled, chamfered, reamed, spot-faced, or tapped on the W. F. & John Barnes fourteen-station, two-way, horizontal transfer machine shown in Fig. 3. The casting is loaded at the first station with its oil-pan face down, locating by means of retractable dowels in the previously reamed manufacturing holes. A six-spindle right-hand head and an eight-spindle left-hand head straddle the second and third stations of the transfer machine. At these two stations, ten holes from 3/8 to 33/64 inch in diameter are drilled, three holes from 0.306 to 0.490 inch in diameter are reamed, and a 1-inch diameter counterbore is machined.

Station No. 4 is idle. A four-spindle right-hand head and a seven-spindle left-hand head straddle the fifth and sixth stations to drill, ream, or chamfer eleven more holes in the ends of the transmission case. The seventh station of the transfer machine is idle. When the castings have been indexed to the eighth and ninth stations, a four-spindle left-hand head is employed to drill two holes 3/8 inch in diameter, ream a 0.5000-inch diameter hole, and machine a 0.562-inch counterbore.

After passing through idle stations Nos. 10 and 11, the castings are tapped at the twelfth and thirteenth stations. An eight-spindle, power-traversed left-hand tapping head with self-leading spindles straddles these two stations to tap seven 5/16–18 holes and one 3/8–18 hole. A similar head is positioned on the right-hand side of Station No. 12 to tap eight 3/8–16 holes and one 9/16–18 hole. The transmission cases are automatically unloaded at the fourteenth and final station of the transfer machine. A production of

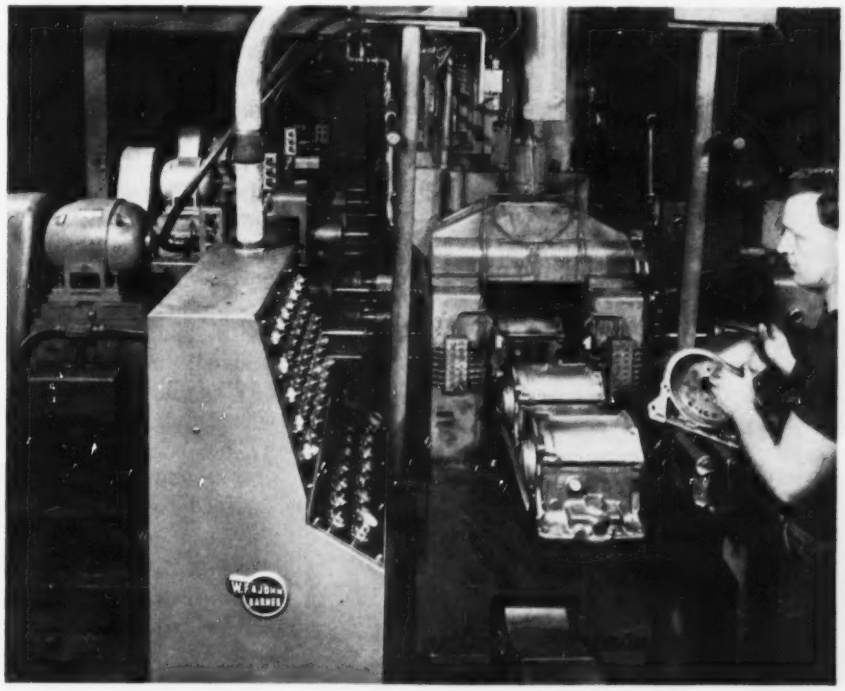


Fig. 3. Holes in the front and rear ends of the transmission case are drilled, chamfered, reamed, spot-faced, or tapped on the machine here shown.

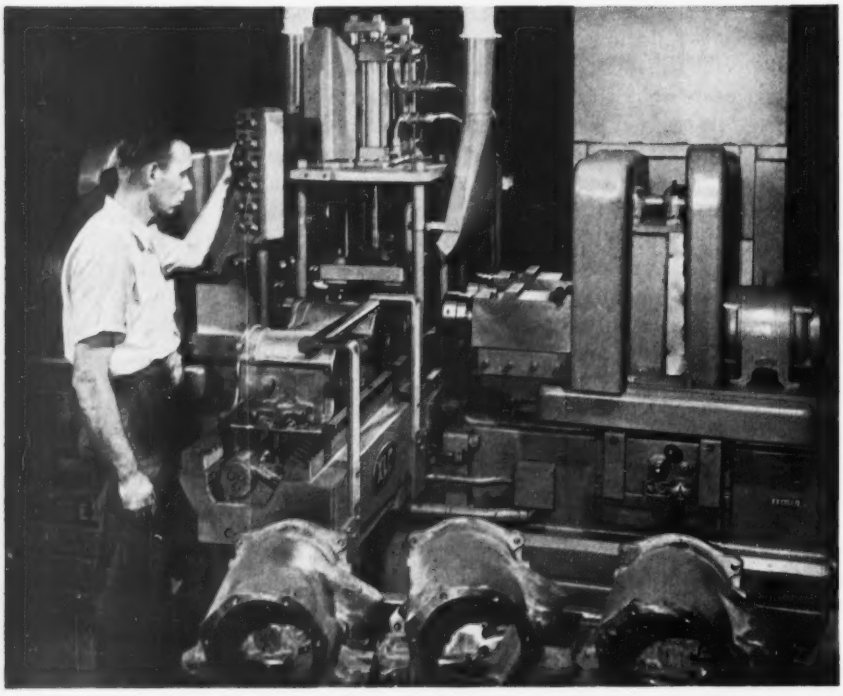


Fig. 4. Castings are loaded two at a time and double indexed on this transfer machine for finish-boring and facing the transmission cases

seventy-four castings per hour is obtained in this operation at 70 per cent efficiency.

Finish-boring and facing of the transmission case are performed on the Ex-Cell-O hydraulic transfer machine seen in Fig. 4. The castings are loaded, two at a time, locating from two 5/8-inch diameter holes, by means of overhead, hydraulically actuated plungers, and the oil-pan faces. At the first station, two holes in the front end of the case are finish-bored, one to a diameter between 7.002 and 7.003 inches and the other between 1.686 and 1.687 inches. After double indexing to the second station, a hole in the rear end is finish-bored to a diameter between 6.375 and 6.376 inches. Also, an inner boss, 3 7/8 inches in diameter, is finish-faced to 4 1/8 inches in diameter by 1.235 inches deep. Squareness of the bores and face is maintained within 0.001 inch.

Most of the holes in the top and bottom surfaces of the transmission case are drilled, chamfered, reamed, or tapped on the Barnesdril twenty-two-station, two-way, hydraulic transfer machine shown in the heading illustration. The castings are loaded with their rear end down, locating from the two finish-bored main-bearing holes and two 0.500-inch diameter holes in the front end. At subsequent stations, forty-five holes are drilled, twenty-five are chamfered, two are reamed, and twenty-five are tapped. The depths of all drilled holes to be tapped are checked at the seventh station of the transfer machine.

The cycle for this transfer machine consists of one second for rapid approach, twenty seconds for feed and dwell, two seconds for rapid return,

Fig. 5. Three concentric "blind" bottom bores are honed on this four-station, rotary indexing machine. Concentricity is held within 0.001 inch.

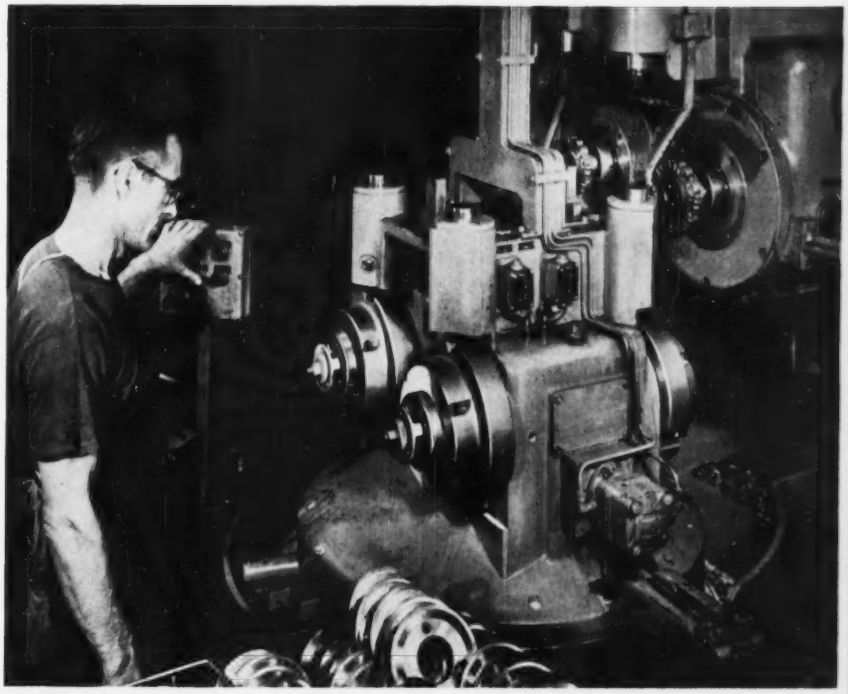


Fig. 6. Special dial type milling machine for cutting three equally spaced clearance slots in planet pinion carrier castings two at a time

and eight seconds for transferring and clamping, resulting in a production of eighty per hour at 70 per cent efficiency. Cutting speeds employed—in surface feet per minute—are 65 and 78 for drilling, 33 and 50 for reaming, 55 for chamfering and spot-facing, and 22 for tapping.

Three concentric "blind" bottom bores in the transmission case for accommodating a servo piston are finished on the Micromatic hydraulic, four-station, rotary indexing honing machine seen in Fig. 5. At the first station of this three-spindle machine, a casting is loaded (oil-pan face up) into one of the four work-holding fixtures on the rotary indexing table. The work-piece is located from the finish-bored main bearing holes, and two reamed holes in the front end of the case, and against the finished front end. Clamping is performed on the rear end of the casting.

When the part has been indexed to the second station, the deepest and smallest bore is honed to a diameter between 1.375 and 1.377 inches. At the third station, the concentric mean-size bore, 1.750 to 1.752 inches in diameter, is honed. The remaining largest bore, 2.5625 to 2.5645 inches in diameter, is honed at the fourth station. All three bores are honed concentric with each other within 0.001-inch total indicator reading.

Honing stones of 180-grit, vitrified-bond, silicon-carbide abrasive are employed for this operation, the abrasive stones being molded into plastic holders and five holders being used on each honing tool. For honing the smallest diameter, blind bottom hole, the abrasive stones had to be located at the extreme lower end of the tool, and

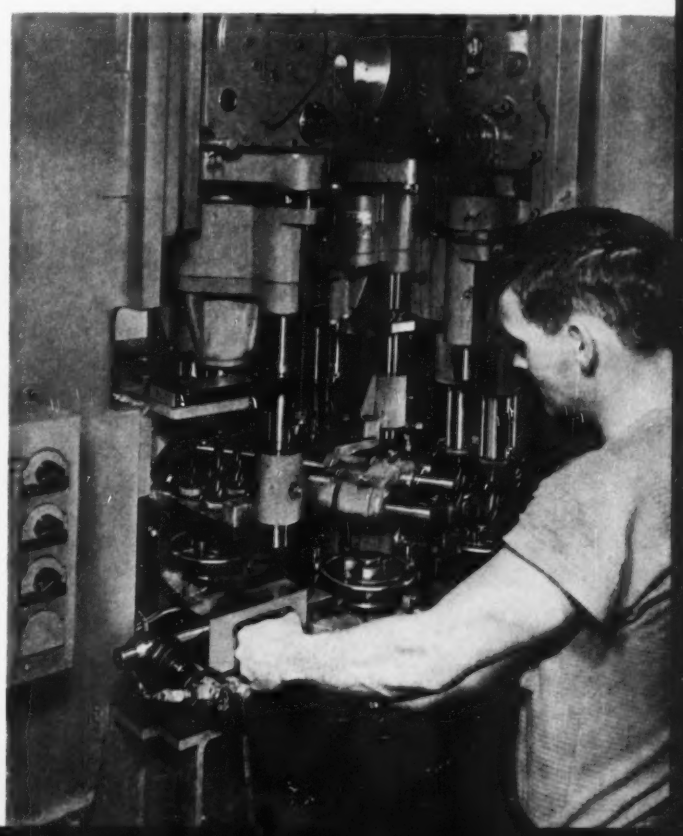


Fig. 7. Three holes through both flanges of the planet pinion carrier are drilled, reamed, and chamfered, and three radial holes are drilled on this machine.

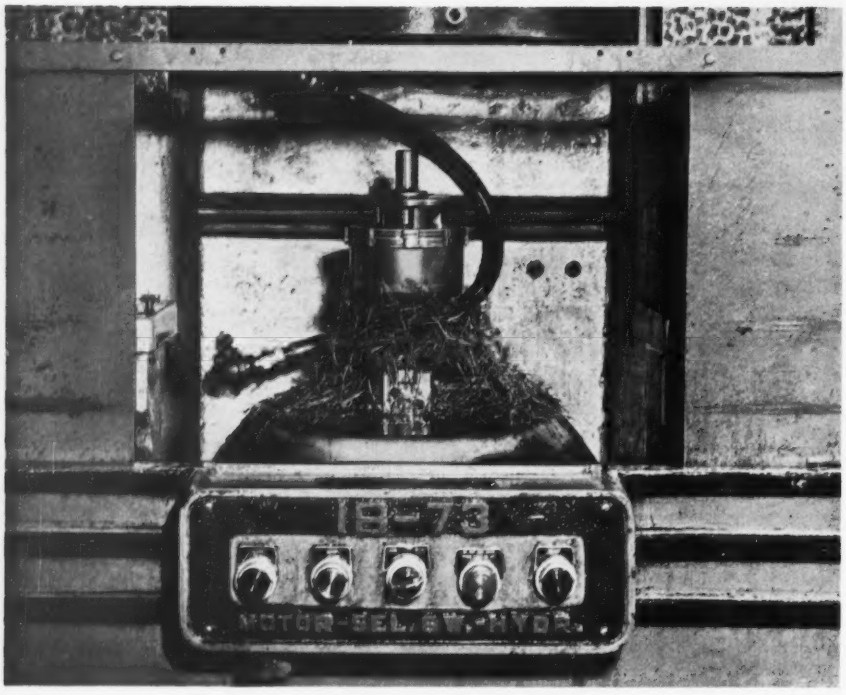


Fig. 8. A set of eight radially fed cutter blades forms eight lugs on the periphery of the pinion carrier flange. Two carriers are machined simultaneously.

the machine was arranged for a slight dwell at the bottom of each stroke.

Because of the design of the transmission case, the plastic sizing tabs on the ends of the abrasive holders could not be stroked out of the bore far enough to contact a conventional type gage ring used with such machines. A new type ring was designed with the insert mounted in long carriers that slip into the larger bores. This brings the insert down to the tabs and, in conjunction with the Microsize electronic control mechanism, automatically expands the honing stones the required amount, stops the expansion when the bore is the correct size, and then collapses the tool and withdraws it from the work.

The honing machine is equipped with a magnetic separator to remove metal and abrasive particles from the coolant. Also, a refrigeration unit is provided to control the temperature of the coolant for this precision operation.

Carriers for the planetary gear set pinions of the automatic transmission are cast from pearlitic malleable iron. Three equally spaced slots that provide clearance for the gears are milled in the

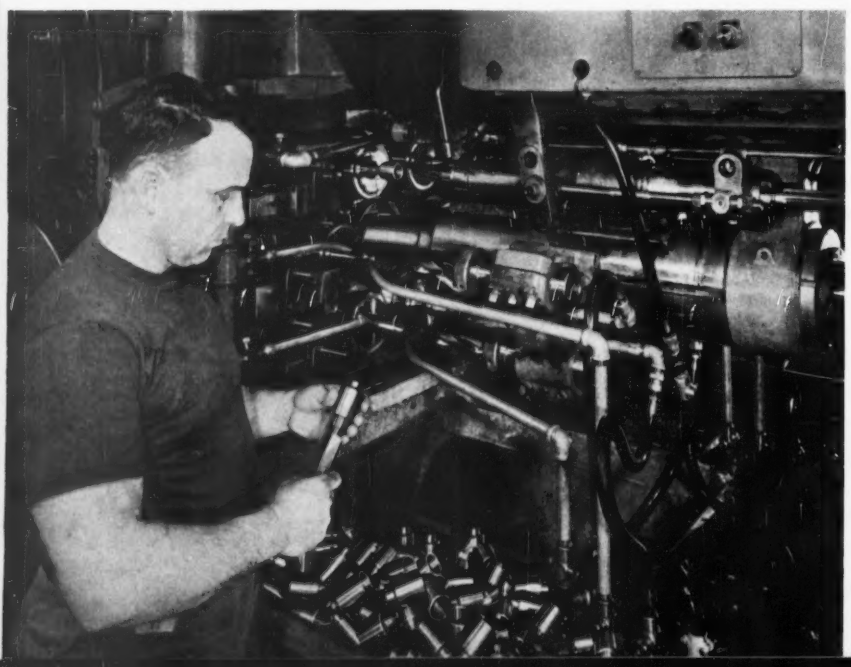


Fig. 9. Six-spindle automatic bar machine for producing transmission reverse servo pistons from 1 5/8-inch diameter stock at the rate of 109 per hour

castings on the special Cross dial type machine illustrated in Fig. 6. The clearance slots are approximately 1 1/4 inches deep by 1 inch wide, and their faces are held parallel within 0.002 inch. The machine is equipped with two cutters for milling two planet pinion carriers at a time, and a two-position, four-spindle, rotary indexing table that permits loading two castings while two more are being milled.

Two carriers are loaded at a time, locating each from its previously rough-machined bore and a drilled hole. When the starting button is depressed, the table is automatically indexed 180 degrees in a horizontal plane and the head carrying the staggered-tooth, helical cutters is fed downward hydraulically to mill two slots. As the head is raised, the work-pieces are indexed 120 degrees in the vertical plane, and two more slots are milled. Finally, the castings are indexed another one-third revolution and the remaining slot in each part is milled. Hydraulically actuated, vertical-acting plungers enter notches in the peripheries of the work-holding fixtures to insure accurate indexing.

Drilling, reaming, and chamfering of the planet pinion carriers are performed on a Kingsbury six-station, twelve-spindle indexing machine, Fig. 7. Each casting is loaded over a vertical plug provided on the six work-holding fixtures on the rotary table. After a carrier has been indexed to the second station, three in-line holes 17/32 inch in diameter are drilled through both flanges of the casting by means of tools mounted on a three-spindle vertical head. Another three-spindle vertical head is provided at the third station to ream these holes to a diameter of 0.5465 inch.

At the fourth station, two holes 0.096 inch in diameter are drilled in the periphery of a small flange on the carrier by means of a horizontal head. The holes that were drilled and reamed through the flanges are chamfered by a three-spindle vertical head at the fifth station. Another 0.096-inch diameter hole is drilled in the planet pinion carrier flange with a horizontal head at the sixth and final station. The completed castings are manually unloaded when they are indexed back to the first station.

The required contour and eight lugs are formed in the periphery of the large flange on the pinion carrier casting by means of Michigan Shear-Speed gear shapers, such as the one seen in Fig. 8. All of the forming is done simulta-

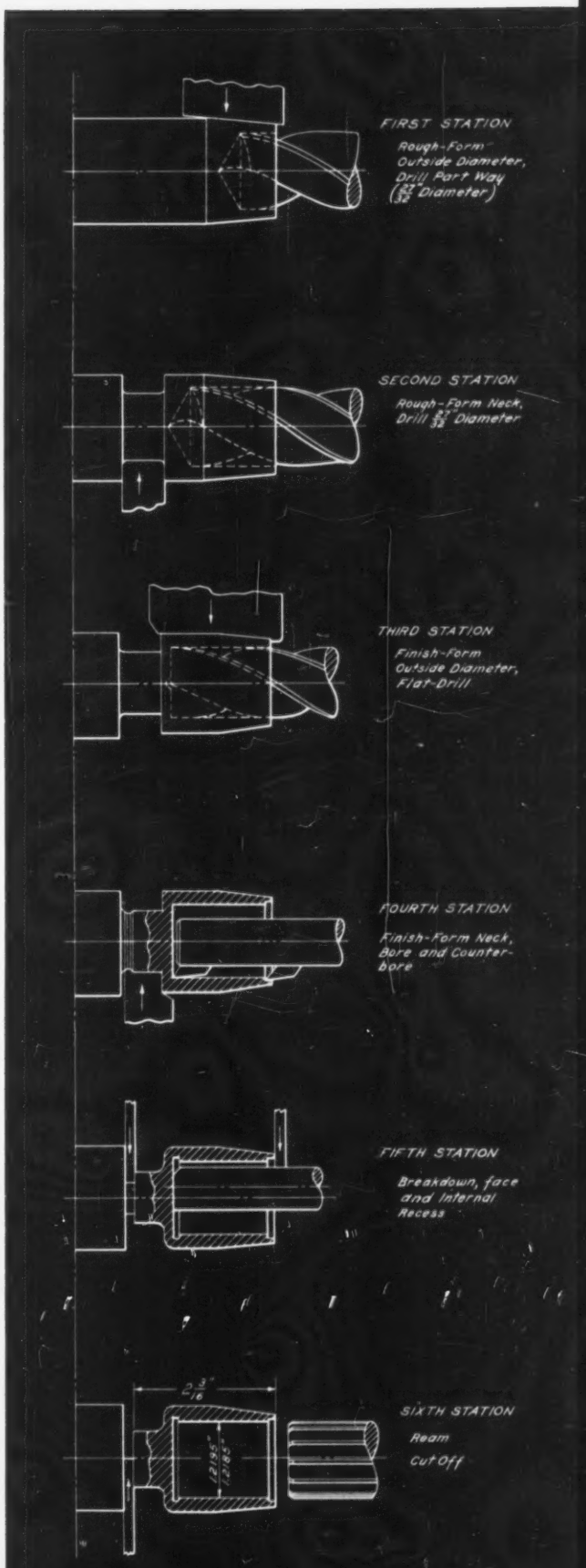


Fig. 10. Tooling lay-out for the automatic seen in Fig. 9. By drilling, boring, and reaming, the blind bore is held to size within plus or minus 0.0005 inch.

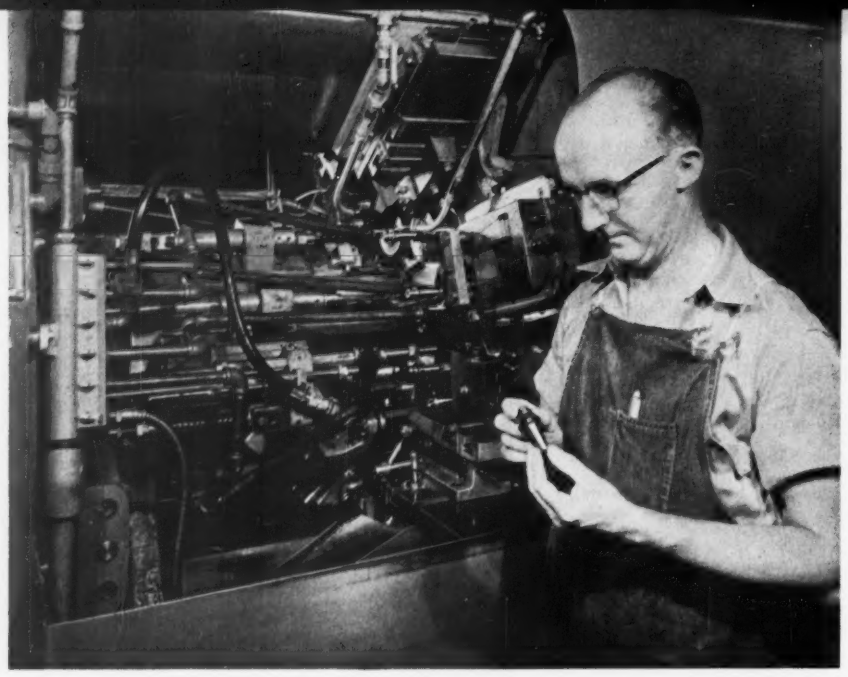


Fig. 11. This eight-spindle automatic bar machine is tooled to roll-form one thread and chase another size thread on the periphery of speedometer drive pinion sleeves

neously, on two work-pieces at a time. Carrier castings are manually placed, two at a time and flange to flange, on an arbor and secured by a hydraulically operated clamping device. A button is then pushed to begin the automatic cycle.

The table on which the work-holding fixture is mounted reciprocates vertically, and a set of eight formed cutter blades is assembled radially in the head of the machine. At the beginning of each upward stroke of the carriers, the blades are fed radially inward a pre-set amount and, on the return stroke, the blades are retracted to avoid drag. A double-step feed cam is employed to obtain this motion of the cutter blades.

Of the many smaller parts produced for the PowerFlite transmission on automatics, two are of special interest. One part, the reverse servo piston for the transmission, is produced on a Conomatic six-spindle automatic bar machine, Fig. 9. The pistons are made from S A E 1110 steel bar stock, 1 5/8 inches in diameter, at the rate of 109 per hour with 70 per cent efficiency. The unusual feature of this operation is that the blind bore in the piston must be held within plus or minus 0.0005 inch of the required size. Also, the outer face of the piston must be held square with the bore within 0.0005 inch total indicator reading.

Tooling used on the six-spindle automatic bar machine is shown diagrammatically in Fig. 10. The spindles are rotated at 373 R.P.M., providing a cutting speed of 159 feet per minute. Rough-forming tools mounted on the cross-slides at the first and second stations are fed 0.0027 inch per revolution, while the 27/32-inch diameter drills on the main tool-slide are fed 0.0072 inch per revolution. The finish-forming tools at the third and fourth stations are fed 0.0012 inch per revolution, and the boring tools 0.0132 inch per revolution. Breakdown, facing, and cut-off blades at the fifth and sixth stations are fed at the rate of 0.0022 inch per revolution, while reaming is performed with a feed of 0.025 inch per revolution.

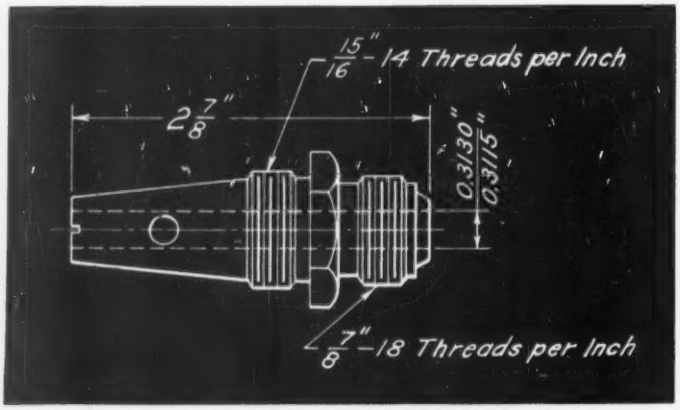


Fig. 12. Sleeve produced on automatic seen in Fig. 11. Run-out of bore with relation to threads is maintained within 0.003 inch

Another interesting operation performed on the automatics is the production of speedometer drive pinion sleeves on an Acme-Gridley eight-spindle, automatic bar machine, Fig. 11. The sleeves, made from SAE 1113 steel, 1 1/16-inch hexagonal bar stock, require two external threads of different size and a reamed bore 2 7/8 inches long, as seen in Fig. 12. Maximum run-out of the bore with respect to the threads must not exceed 0.003-inch total indicator reading.

The 15/16–14 thread is roll-formed by means of two cylindrical dies mounted on the cross-slide at the fourth station of the automatic bar machine. Circular chasers are mounted on the main tool-slide at the seventh station to cut the 7/8–18 thread. The spindles are rotated at 598 R.P.M. to provide a cutting speed of 192 feet per minute. An accelerated speed of 825 R.P.M. is employed for reaming the bore. The main tool-slide is fed at 0.0045 inch per revolution, while the cross-slides are fed at rates varying from 0.0005 to 0.0074 inch per revolution. With a machining cycle of twenty-six seconds, a production of 148 sleeves per hour is obtained at 70 per cent efficiency.

Other interesting operations performed on castings, gears, and aluminum parts for the PowerFlite automatic transmission will be described in the concluding installment of this article to be published in May MACHINERY.

Punch Press Controlled by Electronic Brain

AN electronic brain for an automatic punch press has been developed by General Electric scientists in the company's Electronics Laboratory at Syracuse, N. Y. The machine was described as "one more step toward the automatic factory of the future" in a talk given by Walter Hausz, a manager in the Electronics Laboratory, at an Institute of Radio Engineers symposium on automation. A color sound film showing the punch press in action augmented the talk.

Directions are fed to the press by an electronic digital computer. A perforated card containing information on the size, number, and location of the holes to be punched is "read" by the computer. The punch press automatically positions the work-piece and performs its punching operations to an accuracy of a few thousandths of an inch.

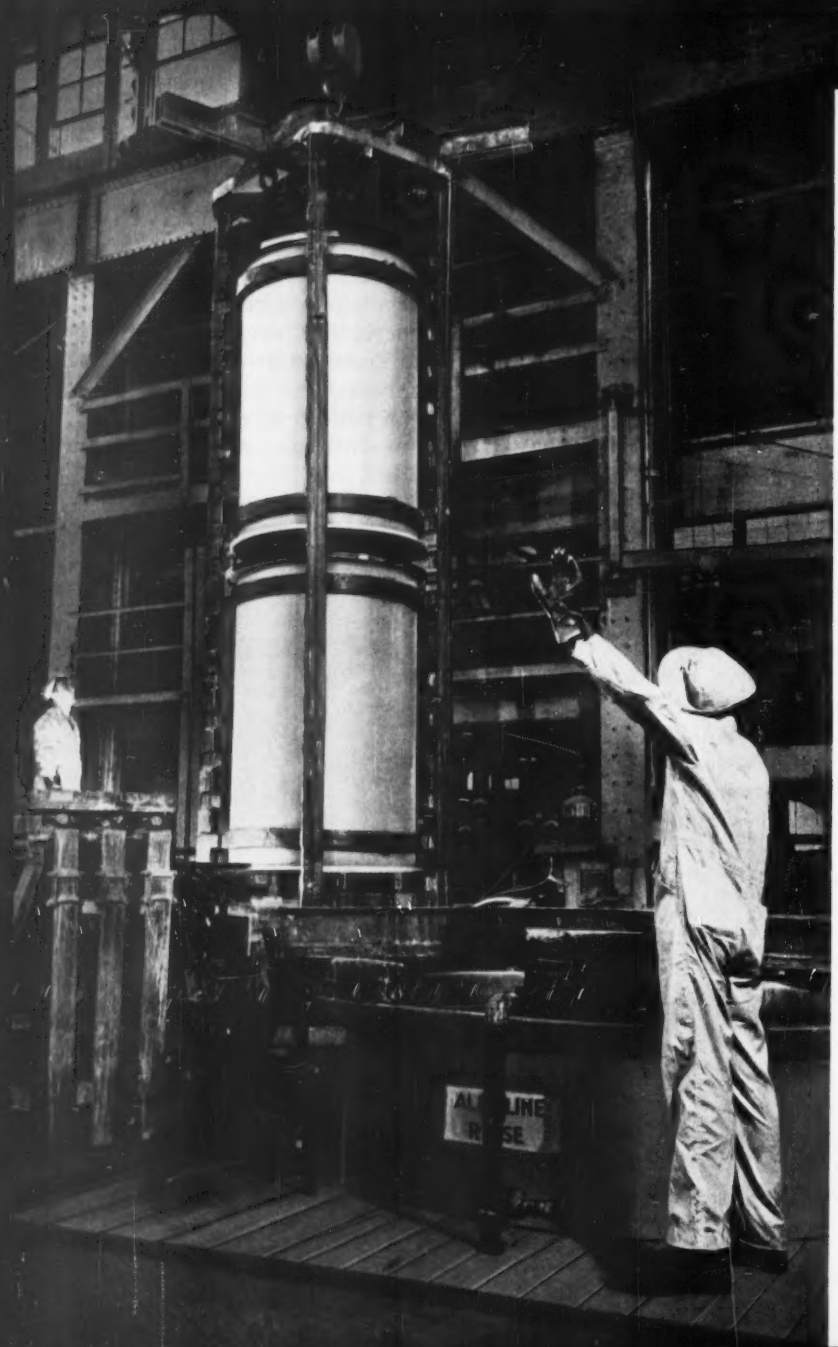
The automatic punch press is a by-product of development work being done by the Syracuse scientists under contract with the Army Signal Corps. This contract calls for the development of a system of automatic machinery to assemble and test electronic circuit sub-assemblies for various military electronic equipment. The Wiedemann turret type punch press was made automatic primarily as a proving ground for techniques and component elements to be embodied in the assembly machine. A version of the punch press could be used to punch holes in printed wiring boards in the preparation of these boards for the placement of various components by the automatic assembly system.

The punch press will be removed from the Laboratory in the near future and placed in a factory for further development and experimental use to determine whether or not it is a practical means for increasing worker productivity in other areas. Techniques employed to make the punch press perform automatically may well be applied to a number of other industrial operations, such as drilling, riveting, stapling, and electrical testing.

Directions are fed to a turret type punch press by an electronic digital computer that "reads" information on the size, number, and location of holes to be punched from a perforated card.

Atomic Energy Production Requires Nickel-Plated Pipe

By Edgar Altholz
Associate Editor



A thin layer of nickel keeps processing pipes and fittings in atomic energy installations free from contamination. A good part of the "plumbing" consists of pipe lengths of 40 feet, having inside diameters ranging from 20 to 54 inches. This article traces the making and plating of the pipe at a western New York plant

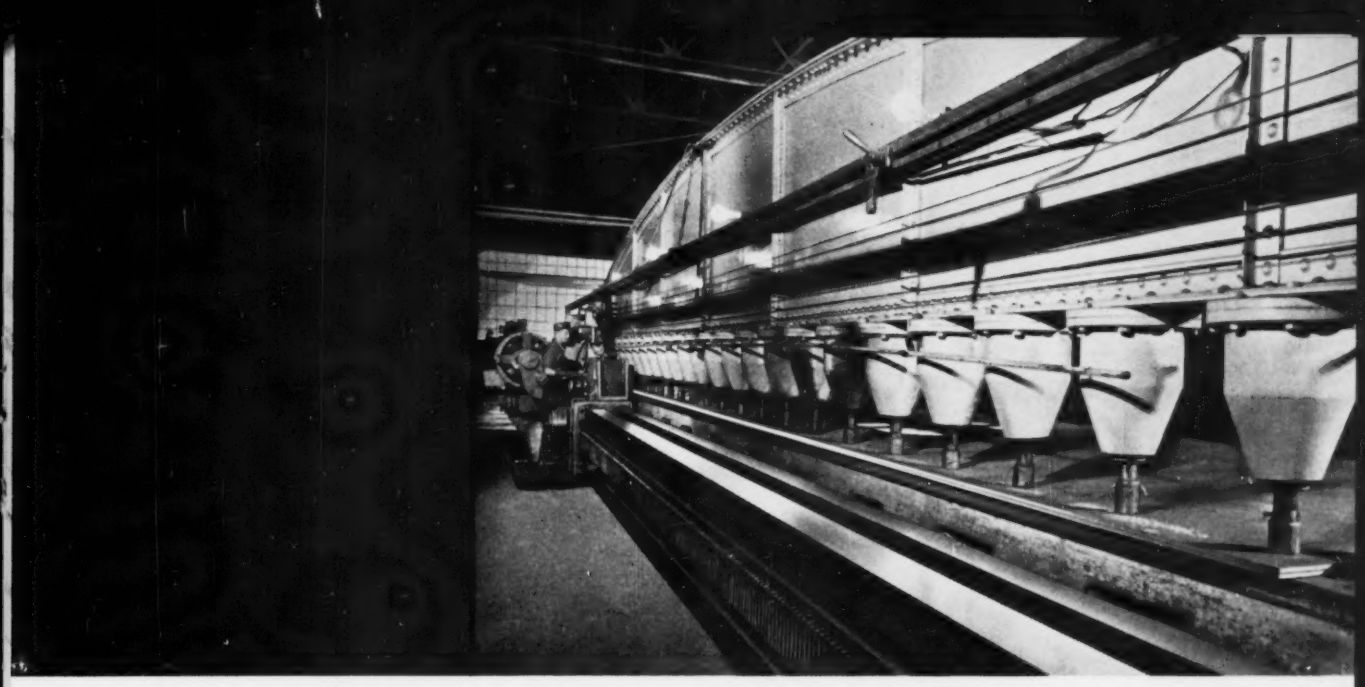


Fig. 1. The two plates being planed to identical width will later be bent into mating semicylindrical sections.

PIPE nickel-plated internally to meet rigid specifications is required by the Atomic Energy Commission for handling highly corrosive and radioactive gases. A principal source of supply of such pipe is the Alco Products Division of the American Locomotive Co., Dunkirk, N. Y. Electroplating facilities and the experience of the concern in fabricating large-diameter pipe, elbows, flanges, and other fittings for water supply and sewerage systems have been successfully integrated in the production of this special kind of pipe.

The pipe to be nickel-plated ranges from 20 to 54 inches in inside diameter. It is made of carbon steel plate, up to 40 feet in length and 1/2 inch in thickness. First, the plates are brought to a planer where their long edges are machined parallel, and beveled for seam-welding. One of the plate planers, a Baldwin-Southwark, is shown in Fig. 1. This machine has a capacity for plates up to 42 feet in length. In the illustration, two plates, each 40 feet long and 3/8 inch thick, are being machined simultaneously. A row of clamps beneath the bridge of the machine secures the plates to the table. The cutting tool is supported from a motor-driven carriage traveling over ways and geared to a rack along the apron of the machine.

Once the edges have been planed and beveled, the plate is conveyed to a crimping machine. This machine, shown in operation in Fig. 2, is essentially a power hammer which, by means of radius dies above and below the work, curves the area of the plate immediately adjacent to each edge. Were this crimping operation omitted, the subsequent bending of the plate would leave a flat area along the seam, and a perfectly round pipe would be impossible to obtain.

During crimping, the plate is supported on a flat car that rolls over tracks directly in front of the machine. The car is gear-driven and its intermittent movement is timed with the stroking of the dies. In this manner, the dies can be effective on plate of any length. Each diameter of pipe requires its own set of dies, since the radius of the crimped areas must obviously correspond to that of the pipe. In the background of the illustration, some of the die sets employed for other pipe sizes are visible.

Bending the Plate

Bending the plate into pipe, Fig. 3, follows crimping. The flat plate is fed back and forth under tremendous pressure between three long horizontal rolls (only two of the rolls are visible) of a Baldwin 40-foot pyramid type bending machine. At first, the curvature of the plate is slight, but with each pass of the plate around the rolls, the center distances between the rolls are decreased by the operator in order to curve the plate still more. In the illustration, bending has been completed, and the plate is now semicylindrical. Two such plates are then welded together to form a length of 54-inch diameter pipe. For smaller pipe—24, 30, 36, and 42 inches in diameter—the full cylinder is bent from a single plate. In each instance, the diameter of the pipe is determined by the original width of the plates as they come off the planing machine seen in Fig. 1.

Preliminary tack-welding to maintain the

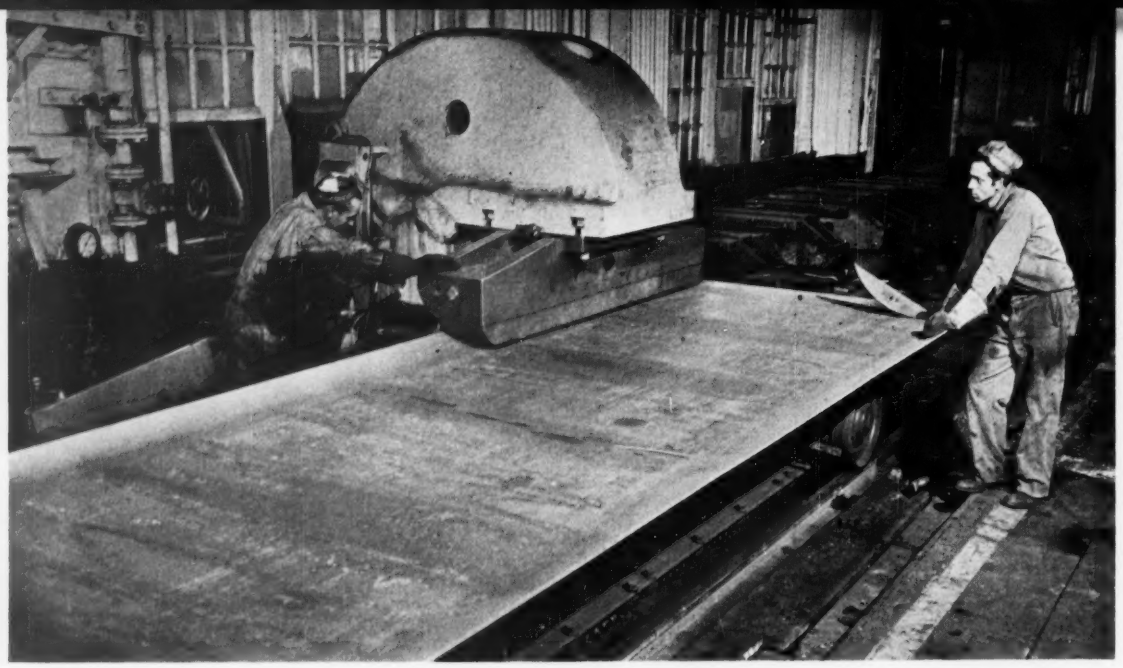
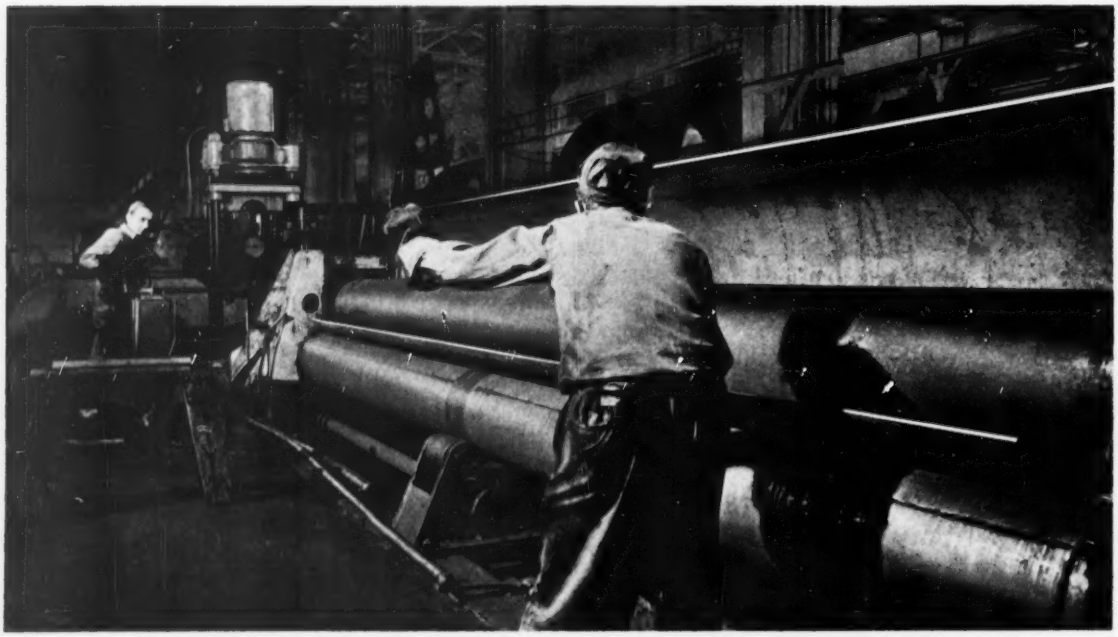


Fig. 2. Because the full width of the plate cannot be bent perfectly, the areas near the edges are first crimped.

alignment of the seams, submerged-arc welding of the outside of the seams, and automatic metal-arc welding of the inside of the seams are the next steps in pipe production. For the tack-welding operation, the pipe is transferred from the bending machine to a spider type fixture which looks very much like a huge lathe steady-rest. The jaws of the fixture converge radially at several points around the pipe, applying pressure to counteract any spring-back from a cylindrical shape.

For the submerged-arc welding of the outside of the seams, a double-housing planer, Fig. 4, was ingeniously adapted with Linde equipment. With the pipe supported in suitable fixtures, welding is performed on the return stroke of the table, the drive for which is routed through reduction gears. In the process, a granular, fusible

Fig. 3. The center distances between the bending rolls is decreased until a semicylindrical section is produced.



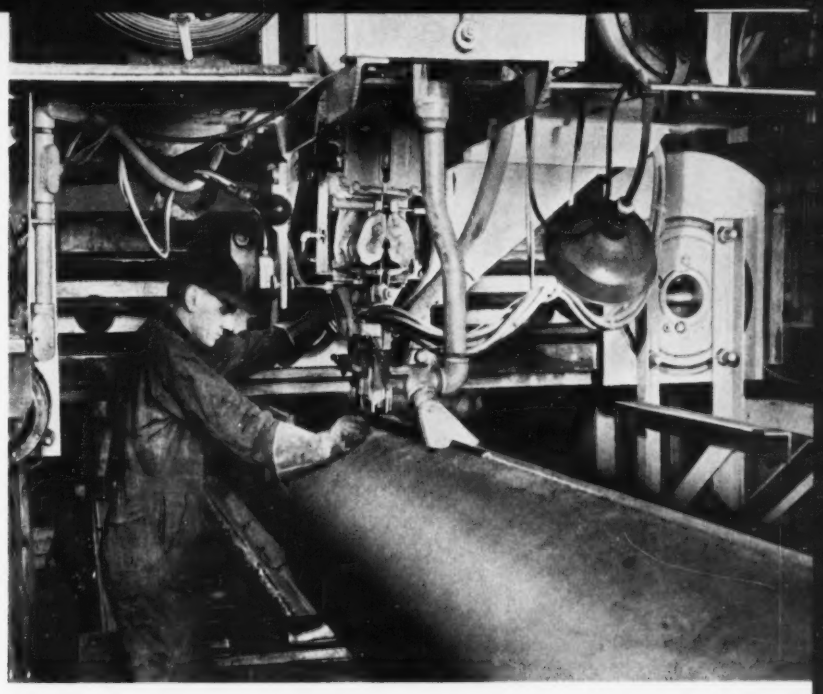


Fig. 4. A double-housing planer has proved to be invaluable for the submerged-arc welding of the outside seam.

flux is deposited ahead of the welding electrode. After an arc is struck beneath the flux, the heat produced melts the surrounding flux. The electrode and base metal of the pipe also become molten.

The fluid flux, displacing the electrode metal, forms a protective blanket. Unfused flux is removed by a vacuum system as the welding operation advances along the seam. Speed, deep penetration, negligible shrinkage, and a bead that is impermeable, uniform, ductile, and even stronger than the pipe metal itself, are some of the features of submerged-arc welding.

Welding of the inside seam is performed by an automatic internal welding machine. Since it is the inner surface of the pipe that is critical, it is important that this weld be skillfully performed. Welds to be plated successfully must furthermore be free of foreign inclusions.

A hand grinding operation, Fig. 5, smooths out the bead, and removes slag and spatter from the welded area. When one realizes that some sizes of pipe are barely large enough to admit the worker in a prone position and yet rigid standards must be maintained, the difficulties encountered in making the pipe become apparent.

An oxy-acetylene torch is used to burn the welded pipe into specified finished lengths. This operation is illustrated in Fig. 6. The pipe is cradled in a series of rolls that are mechanically driven to rotate the pipe slowly as the burning proceeds.

Because of its flexibility, the set-up can be used for pipe of different diameter and length, it being possible to adjust the center distance between each pair of rolls and the lateral position of the burning head. After being cut off, the ends of each length are ground smooth. Inspectors check the pipe for roundness, and correction of any out-of-round condition is made at this time on a press.

The fabrication of other necessary elements of the piping systems—flanges, elbows, and fittings—proceeds simultaneously along other production lines. For example, elbows are developed from flat plate by means of a template-controlled

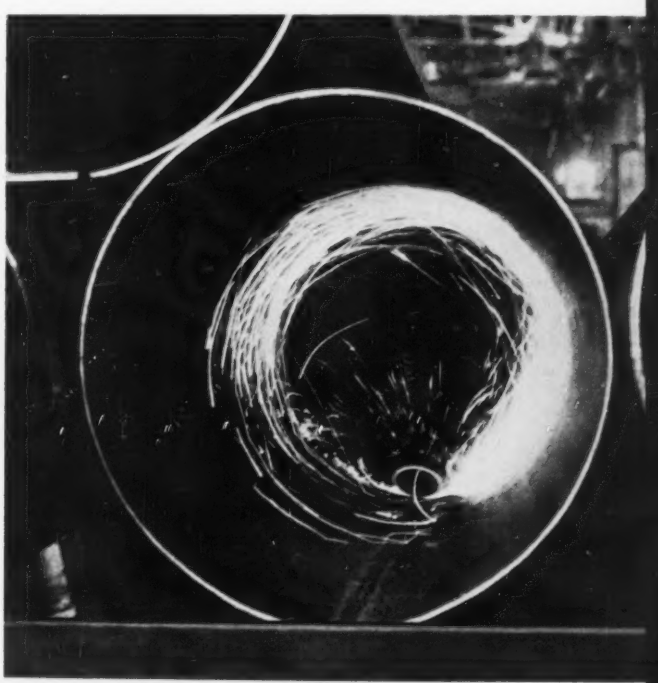


Fig. 5. To assure that the nickel will adhere to the seam, pitted and spalled areas must first be ground down.

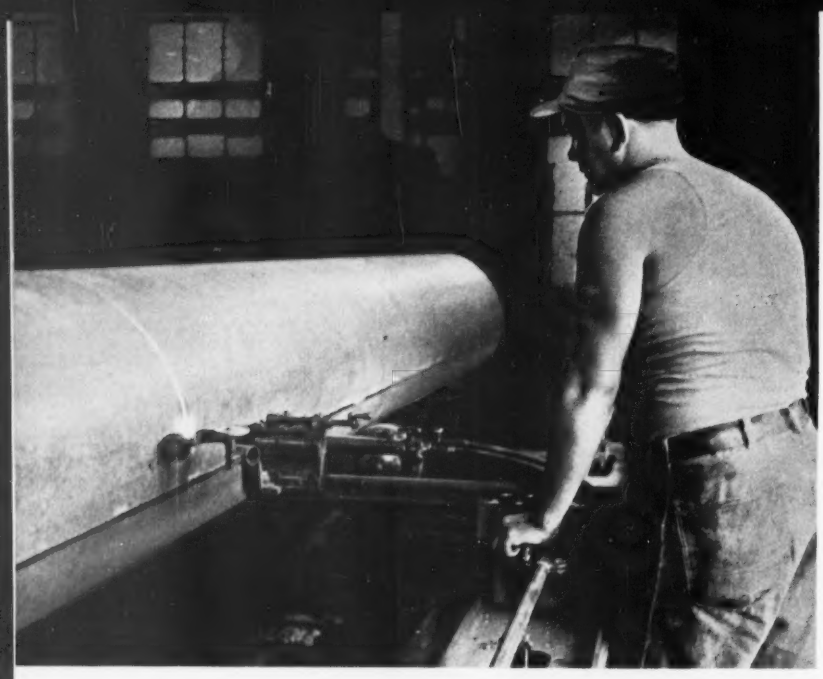


Fig. 6. Oxy-acetylene burning provides a rapid method of cutting the welded pipe to the specified lengths.

automatic burning machine. The shapes thus obtained are pressed into two flat elbows, then both halves are fitted and welded in a procedure similar to that followed for the pipe.

Flanges are welded to each end of the pipe. Since the weld must be made in a downhand position, some of the longer lengths posed a problem until it was solved by the use of special fixtures and rigging that permit the welders to work high above the floor level.

Facing the Flanges

Facing the flanges is necessary after they have been welded to bring them to the specified dimension and also to assure that they are normal to the axis of the pipe. As the work revolves on the huge lathe, Fig. 7, both faces are machined simultaneously by the infeed of the two cross-slides. An expanding shoe plate set in each end of the pipe centralizes and supports the work for the between-centers operation.

Some flanges are faced on the large floor type horizontal boring mill seen in Fig. 8. The spindle of the mill carries two facing heads, one at each end of the pipe, balancing each other diametrically. For every revolution of the spindle, a star-wheel at the end of a slide-screw in each of the heads is caused to turn slightly, thereby feeding the cutter. The outboard support of the mill can be adjusted laterally to accommodate pipe of different length.

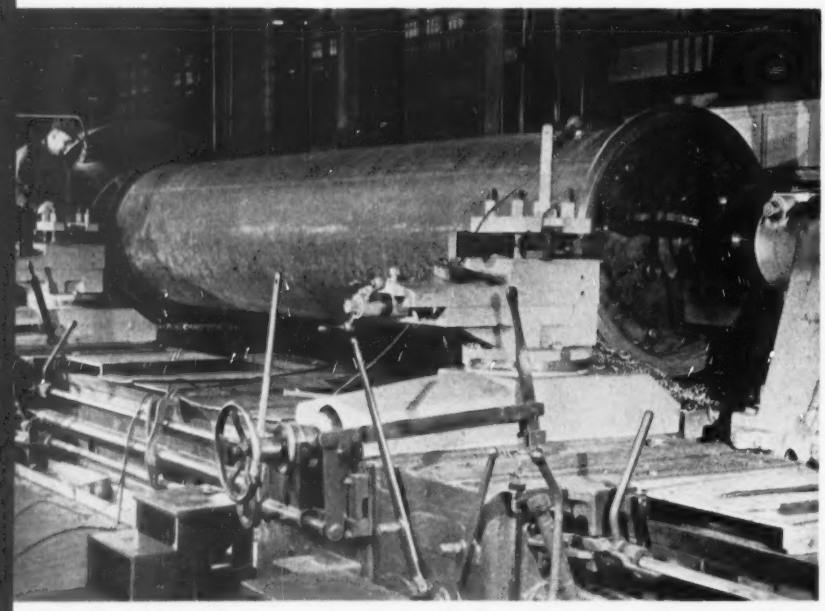


Fig. 7. Two cross-slides, one at each end of this mammoth engine lathe, feed in to face both pipe flanges at the same time.

Fig. 8. Pipe flanges are also faced on this horizontal boring mill by means of star-wheel type facing heads.

After the completion of all forming, machining, and welding operations, the pipe is conveyed to a special area where it is subjected to a thorough sand blasting prior to being nickel-plated. It is important that any inclusions, mill scale, or discoloration be removed. Special grades of abrasive sand and Pangborn equipment are used for the sand blasting.

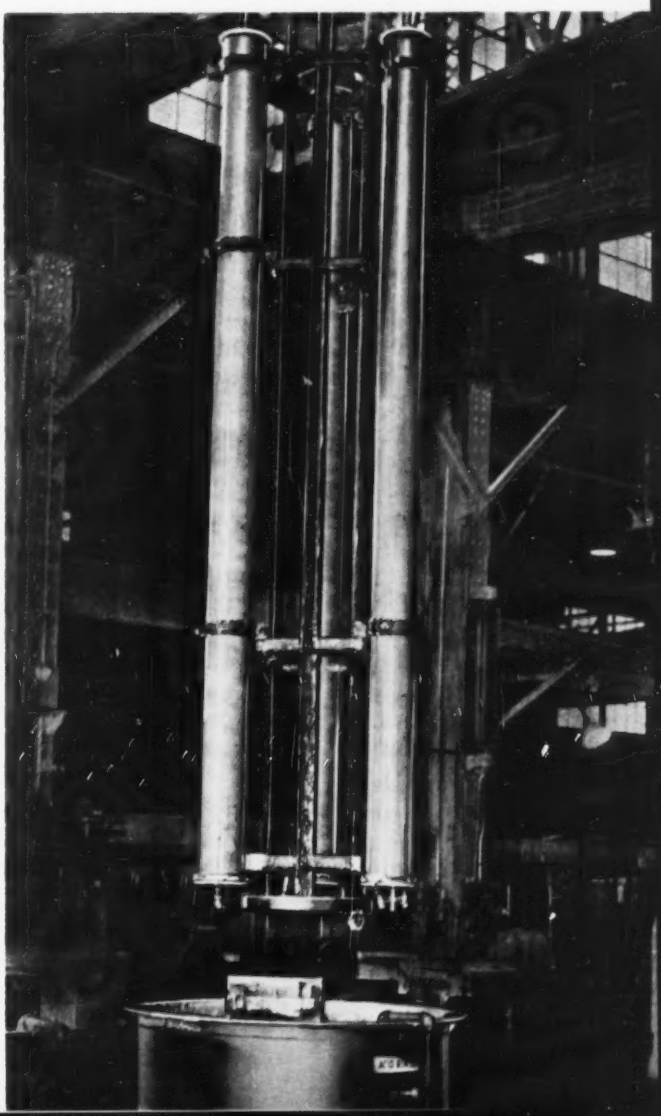
Nickel-Plating

The plating process, although involving no fundamentally new laboratory problems, did present the very real engineering problem of successfully handling larger and heavier masses than had heretofore ever been attempted on a production basis. Since the pipe is supported in a vertical position for the preparatory treatment and for the plating itself, provision had to be made for considerable head-room in the plant structure. A large area of the floor had to be excavated to accommodate the battery of plating tanks, which are 22 feet deep and have diameters as great as 9 feet.

How the pipe is handled can be seen in the heading illustration. A fixture, known as a rack, encloses the pipe and serves as a framework for clamps that are strapped around the pipe. Large-diameter pipe lengths up to 20 feet long can be held singly in the rack, or two shorter lengths can be held in tandem, as illustrated. Also, as in Fig. 9, three long pipe lengths of moderate diameter can be grouped radially and plated at the same time. A powerful crane raises and lowers the rack from bath to bath in the plating cycle.

The pipe goes through nine different immersions, each of which may be considered a distinct step of the cycle: (1) alkaline cleaner; (2) cold

Fig. 9. Three pipe lengths of moderate diameter can be grouped around a fixture and plated simultaneously.



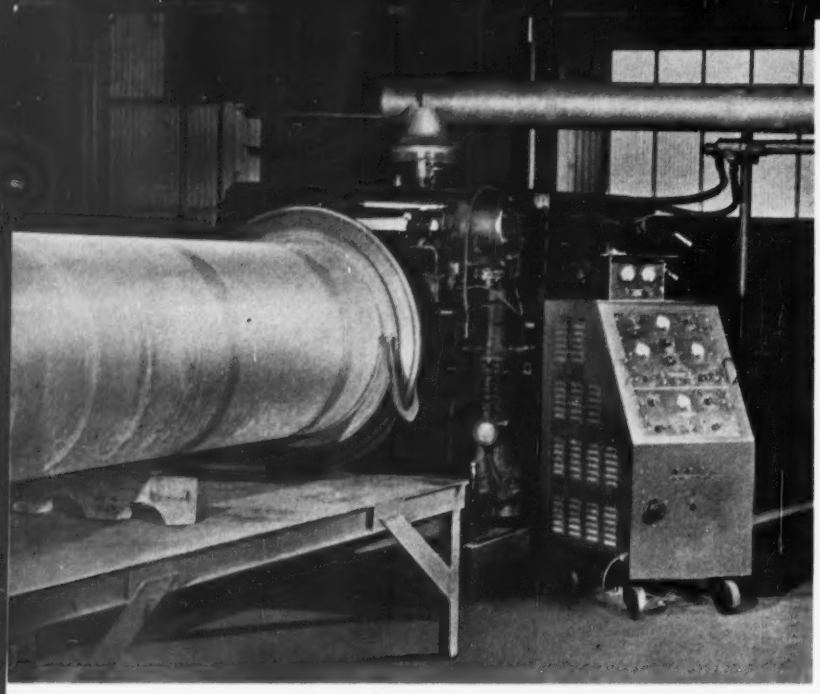


Fig. 10. With the pipe pumped out to an almost perfect vacuum, the mass spectrometer test detects even microscopic porosity.

water; (3) sulphuric acid; (4) cold water; (5) muriatic acid; (6) cold water; (7) nickel-plating solution; (8) cold water; and (9) hot water. For the plating to adhere properly to the base metal, preliminary cleaning and acid treatments are mandatory and their importance cannot be overemphasized. The pipe must, so to speak, be practically surgically clean when it enters the plating solution.

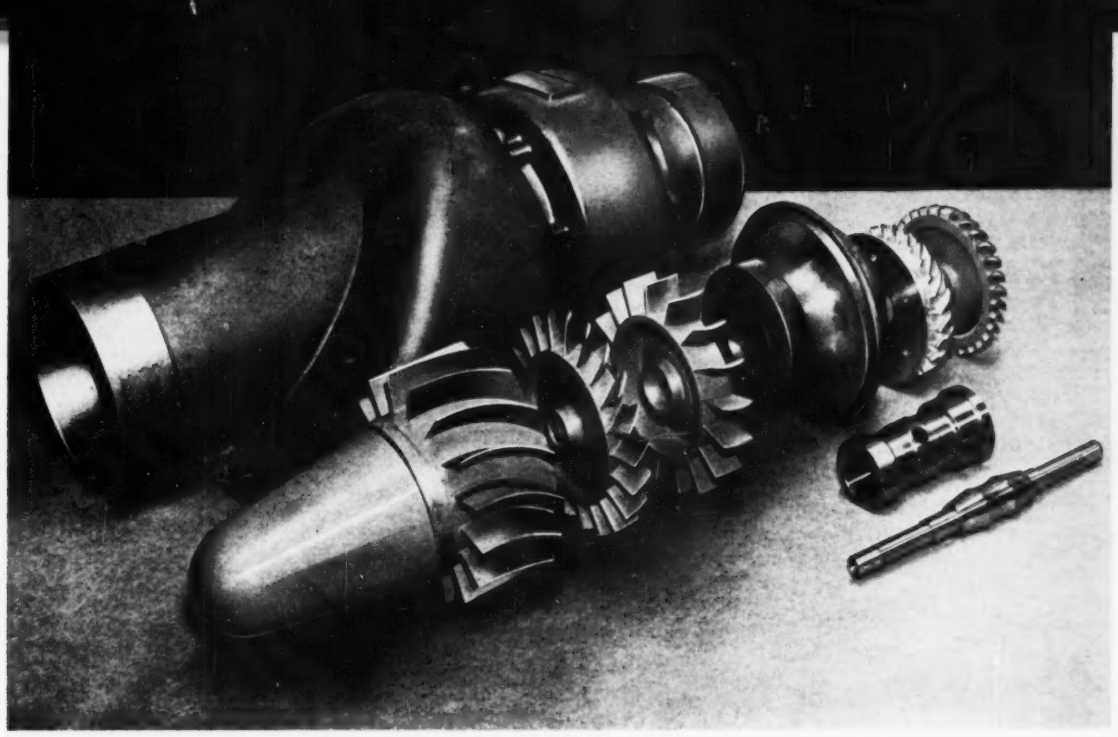
In the plating bath proper, special fixtures hold anodes of pure nickel wrapped in cloth filters in suspension within the pipe, and the work itself forms the cathode. Anodes that have been consumed beyond the point of effectiveness for plating the inside of the pipe are grouped around its outside. Plating the outside, although not functionally important, prolongs the purity of the solution. The tremendous amount of current required by the plating operations—100,000 amperes at 12-volt generator capacity—is supplied by an installation containing twenty-five motor-generator sets.

During the immersion of the pipe in the plating solution, the bath is continuously agitated to assure a uniform deposit of the nickel. Following plating, the anode and cathode terminals are removed and the pipe is given the last two rinses of the cycle.

Atomic Energy Commission standards for the plating call for absolute adherence and minimum porosity. Adherence of the nickel to the base metal of the pipe is checked by performing a flexure test on a small piece of the metal from which the pipe has been made, and which has accompanied the pipe through the plating cycle. The specimen is bent 180 degrees around a 2-inch mandrel, then straightened and bent 40 degrees in the opposite direction. No flaking, chipping, or peeling must occur.

To guard against any porosity in the nickel plate, which would inevitably lead to corrosion, the pipe is subjected to a severe mass spectrometer test. The set-up for this test is shown in Fig. 10. One end of the pipe is sealed and the other is clamped against the rubber diaphragm of a vacuum system. With the pipe pumped out to less than one-millionth of an atmosphere (one atmosphere being approximately 14.7 pounds per square inch), the pipe is covered with a hood, under which helium is injected. Any leaks, however microscopic, are immediately detected and indicated by the dials of the spectrometer.

The pipe, now handled in a horizontal position, is put through a post-plating cycle of four additional baths: (1) degreasing; (2) acid etching; (3) cold rinsing; and (4) hot rinsing. With absolute cleanliness thus assured, galvanized covers are sealed over the ends of the pipe prior to shipment by rail.



Aircraft Refrigeration Units Machined by Precision Methods

Parts for compact refrigeration units employed to cool the cockpits of high-speed jet aircraft must be extremely accurate and lightweight. Methods used at Stratos to produce these units are described in this article.

By CHARLES H. WICK
Associate Editor

JET-BLEED, air-cycle refrigeration units for cooling the cockpits of high-speed jet aircraft are one of the products made by the Stratos Division of the Fairchild Engine & Airplane Corporation in a trim new plant located at Bay Shore, N. Y. Parts for these compact, lightweight refrigeration units must be extremely accurate to operate at the high speeds necessary for efficiency.

The refrigeration units operate on the jet-bleed principle, using air bled from the compressor of the jet engine. This compressed, high-pressure, high-temperature air is precooled in an air-to-air, finned aluminum heat exchanger, and refrigerated by expanding through a small axial-flow air turbine. Energy absorbed by the turbine is utilized to drive the blower that draws air through the heat exchanger.

Various models of the refrigeration units have outputs ranging from 10 to over 100 pounds of air per minute. Major machined parts for the Stratos air-cycle refrigeration unit employed to cool the three-man crew of the Boeing B-47 Stratojet bomber are shown in the heading illustration. Seen from left to right (in front of the housing) are the cooling air diffuser, suction fan, inducer, intermediate housing, turbine nozzle, and turbine wheel. The shaft and bearing cartridge are shown in the foreground.

This particular unit weighs less than 45 pounds and occupies less than 3 cubic feet of space. Nominal air flow is 60 pounds per minute, with an inlet bleed air temperature of 588 degrees F. and a turbine outlet temperature of 4 degrees F. Another refrigeration unit, used to cool the cockpit of the Douglas A2D "Skyshark," weighs only 15 pounds and occupies approximately 1 cubic foot. Nominal air flow for this

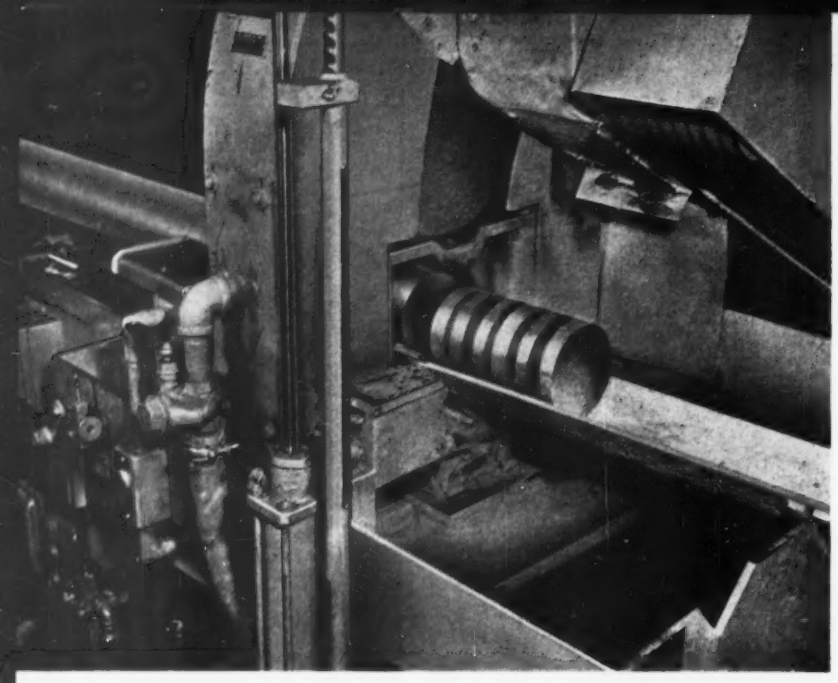


Fig. 1. Automatic abrasive cut-off machine permits rapid cutting by a combination oscillating and rotating movement of hydraulically fed wheel.

unit is 15 pounds per minute, inlet bleed air temperature is 655 degrees F., and turbine outlet temperature is 5 degrees F.

Blanks and slugs for gears, fan wheels, and other parts of the refrigeration units are cut from bar stock on the Campbell automatic, abrasive cut-off machine seen in Fig. 1. Bars up to 6 1/4 inches in diameter can be cut, and close tolerances are held on the cut-off lengths. A 10-foot long aluminum bar, 6 inches in diameter, can be automatically cut into fifty-five 2-inch thick slugs in approximately two hours, without the attention of an operator. With previous methods, this same operation required about eight hours. The cut surfaces are free from surface hardening, smooth, and free of burrs.

Rapid cutting (approximately seven seconds per square inch) is obtained by a combination oscillating and rotating movement of the hydraulically fed abrasive cutting wheel. Little material is wasted since the 20-inch diameter abrasive wheel is only 1/8 inch thick. Coolant is picked up by the revolving abrasive wheel and directed into the cut. Positioning and clamping of the stock, as well as feeding of the wheel, are automatically controlled.

Aluminum-alloy blanks cut from bar stock in this way for the fan wheel of the air-cycle cooling unit used in the Boeing B-47 Stratojet bomber are machined on the Potter & Johnston Model 3U Speed-Flex automatic turret lathe seen in Fig. 2. Since the fan operates at about 48,000

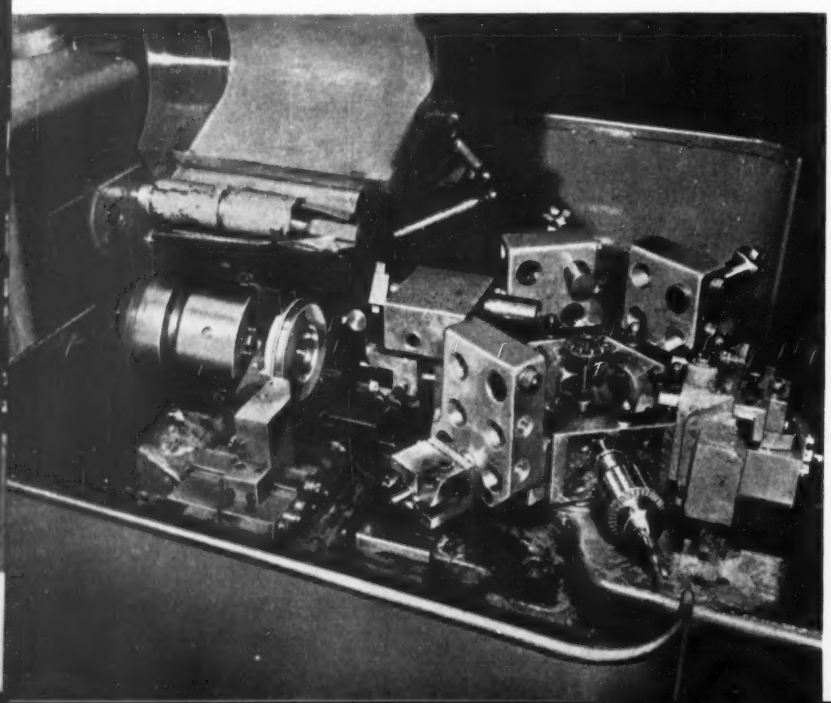


Fig. 2. Aluminum-alloy fan wheel blanks are machined in six minutes on this automatic turret lathe, compared with thirty-eight minutes previously required.

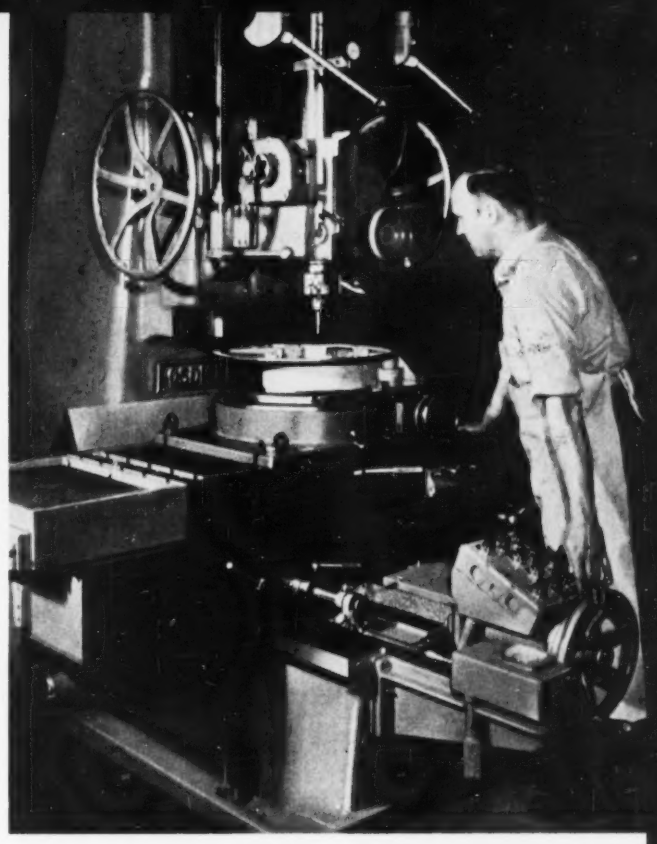


Fig. 3. Automatic, push-button controlled positioning of table and cross-slide within 0.0001-inch is provided on this jig-boring machine for producing accurate parts.

R.P.M., close tolerances must be maintained and precision machining is required. The fan wheel blank is drilled, chamfered, faced, bored, and turned. Previous methods of machining required thirty-eight minutes per part, and now each work-piece is completed in six minutes, floor-to-floor time.

The automatic chucking machine is equipped with six turret faces that will hold up to twenty-four different cutting tools. Both front and rear cross-slides can be operated independently or together when any turret face has been advanced to cutting position. Also, means are provided for operating a slide tool on the turret. Adjustable dogs on a drum operate switches that control the cutting speed and feed, permitting four automatic speed changes and three automatic feed changes for each set of pick-off gears.

Idle time is reduced to a minimum by the rapid traverse of the turret-slide to and from the cutting positions. Cutting speeds for the operation illustrated vary automatically from 30 to 105 feet per minute, and the feeds from 0.007 to 0.014 inch per revolution. The flexibility of this machine makes it suitable for the production of minimum size lots made up of only about 200 work-pieces.

Another machine especially suitable for the manufacturing of even smaller quantities of various precision parts is the Fosdick automatic positioning, jig-boring machine shown in Fig. 3. With this machine, precise parts can be accurately reproduced without the need for costly jigs. Both the cross-slide and the table of the jig-borer can be quickly and automatically positioned by means of push-buttons, with an accuracy as close as 0.0001 inch.

Automatic positioning of the table and slide is accomplished with four electric motors, two of which are used for rapid traversing and two for final positioning. Accurate location of the position to which the table and cross-slide are automatically traversed is controlled by duplicating bars or standard measuring rods. The bars or rods, with separate micrometer-adjusting blocks,

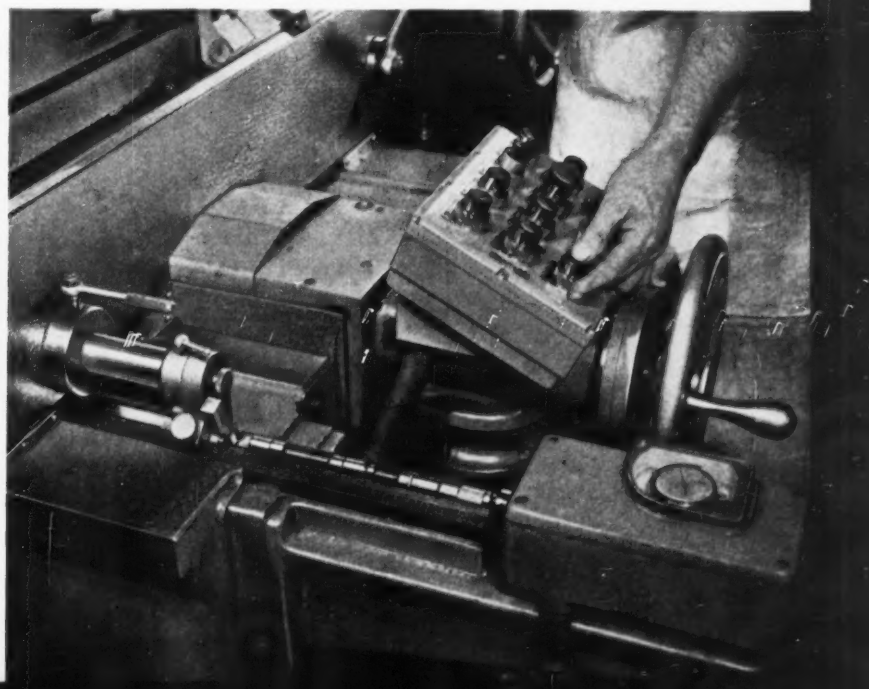


Fig. 4. Close-up view of the jig-borer seen in Fig. 3, showing the duplicating bars, micrometer adjusting block, and dial-indicating gage employed

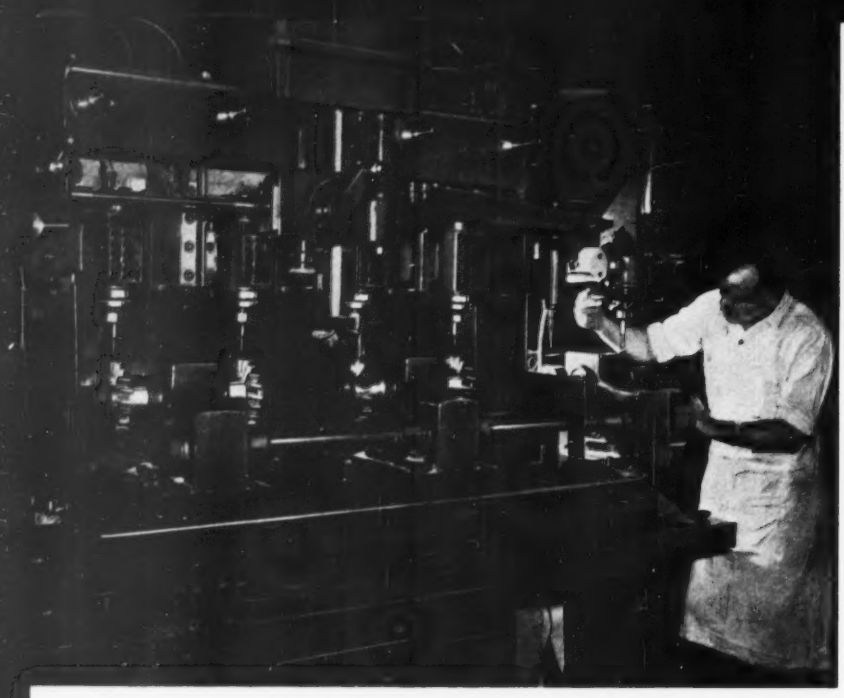


Fig. 5. Special four-spindle profiling machine for cutting the airfoil surfaces and root fillets of vanes on fan and inducer wheels

are placed in troughs on the machine, in front of the dial-indicating gage, as seen in Fig. 4.

When the proper push-button is depressed, the machine table is rapidly traversed to within 1/16 inch of the desired position. A micro switch then interrupts the current flowing to the rapid-traversing motor and energizes the motor, which moves the table to the desired position. The same operation can then be duplicated to position the cross-slide, or both the slide and table can be positioned simultaneously in less than a minute.

Only two duplicating bars—one for the table and one for the cross-slide—are required for each different part to be produced. The bars can be made from standard 5/8-inch diameter rod, and are usually retained in stock in case the parts have to be reproduced at some subsequent date.

Intricate contours on the vanes of fan and inducer wheels are machined in three dimensions, four wheels at a time, on the special Cincinnati four-spindle profiling machine seen in Fig. 5. Profiles of the airfoil surfaces and fillets at the roots of the vanes are completely machined, on all four work-pieces, in approximately two hours (for the size wheel shown). The previous method of manufacturing, on a single-spindle profiling machine, required approximately fifteen hours for four wheels. Also, the set-up time for the four-spindle machine is only about three hours, compared to twelve hours previously required on the single-spindle machine.

Precision duplication of the profile contours in

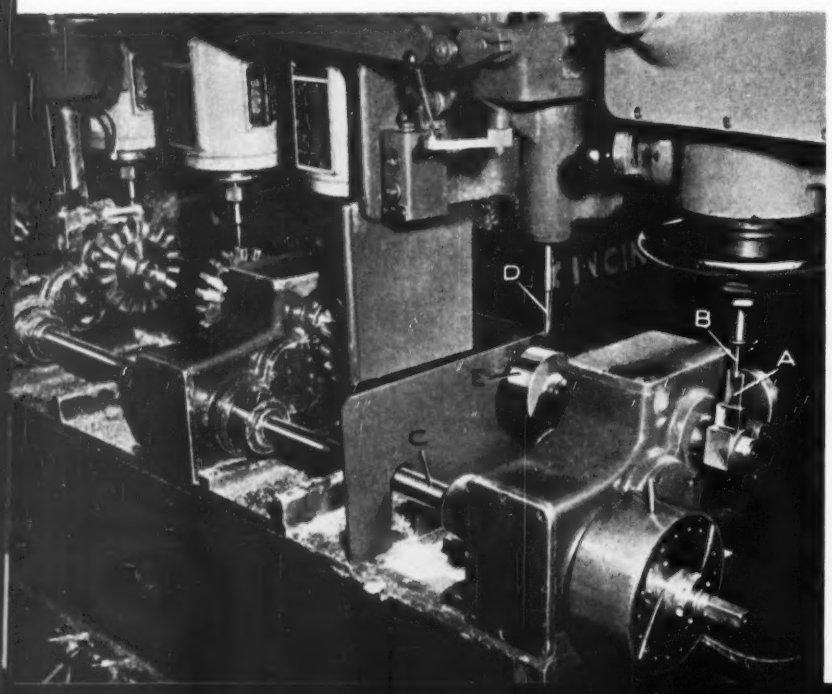


Fig. 6. Close-up view of hydraulic tracer mechanism on profiling machine seen in Fig. 5. (A) is master, (B) the tracing stylus, and (D) the depth stop-pin.

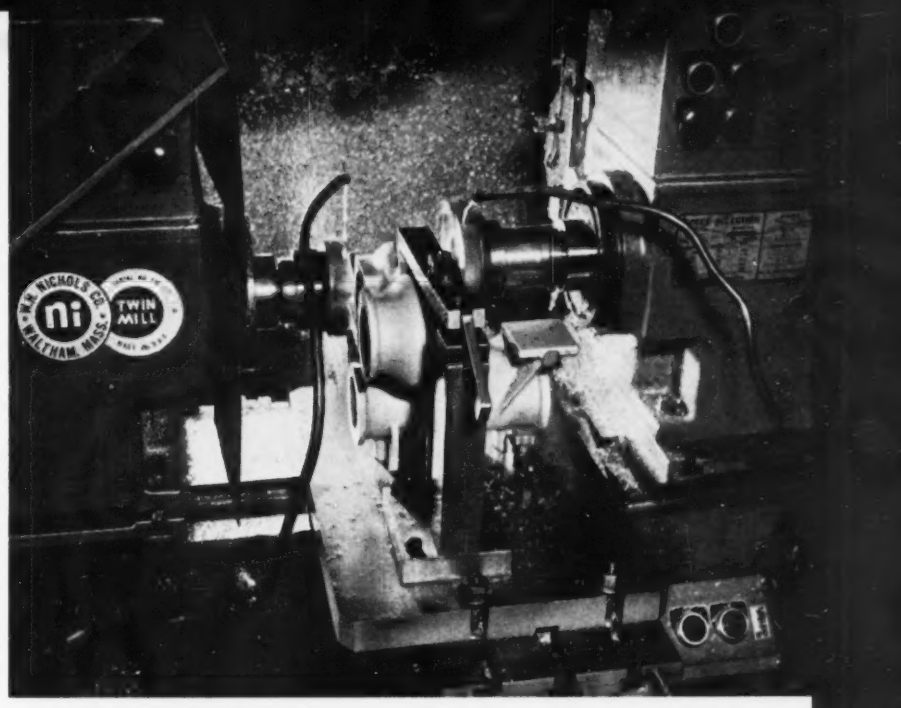


Fig. 7. Multiple operations are performed on several cast aluminum-alloy housings at a time with this double-spindle milling machine.

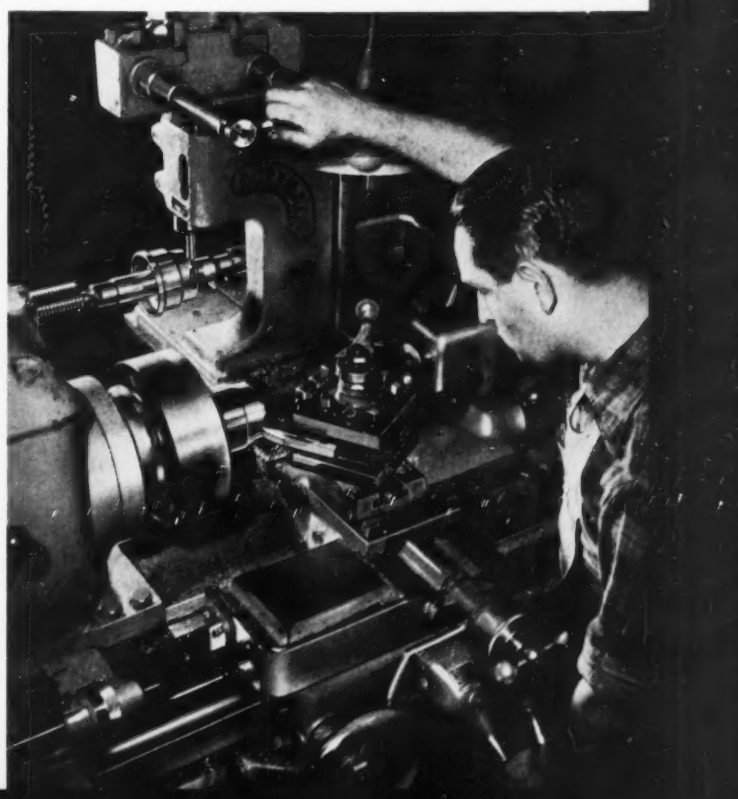
three dimensions is automatically controlled by a hydraulic, 360-degree tracer mechanism and a master, seen at *A* in Fig. 6. Identical work is performed at each of the four stations, but the operation is controlled at a single point with only one master. As the tracing stylus *B* travels over the surface of the master, shaft *C*—to which the work-holding fixtures are connected—is oscillated, thus moving the vanes on the work-pieces toward or away from the cutters. Downward feed of the cutters and stylus is automatically stopped when pin *D* contacts drum *E*. Cutters are individually motor-driven at 17,200 R.P.M.

Cast aluminum-alloy housings are machined on the Nichols double-spindle, precision milling machine seen in Fig. 7. Both opposed heads on this versatile twin-mill can be adjusted horizontally, vertically, and transversely. Vertical attachments can be fitted to either spindle so that the machine is usable for either vertical or horizontal milling operations, or a combination of both, thus providing maximum flexibility. By performing multiple operations on several parts at a time, as shown, milling time has been reduced as much as 60 per cent, and the number of fixtures that would normally be required has been reduced.

Multiple-diameter shafts and contoured parts are automatically duplicated from a round or flat template on the Lodge & Shipley lathe seen in Fig. 8, which is equipped with a Copymatic hydraulic tracer control. A finished part is being used as a template for duplicating the balance of the work-pieces in the operation illustrated.

Fig. 8. A finished multiple-diameter part, seen mounted between the centers at rear of lathe, is employed as template to duplicate the balance of work-pieces required.

The hydraulic cylinder for controlling transverse travel of the cross-slide is mounted on the rear of the lathe carriage, with the piston-rod connected to the cross-feed screw and tracer support bracket so that both the cross-slide and tracer head move in unison. The template is supported between centers at the rear of the lathe. Forward and reverse rapid traverse and feed to the lathe cross-slide are hydraulically controlled by a three-way valve in the tracer head, seen above the template at the rear center with the stylus in contact with the template. The rate of



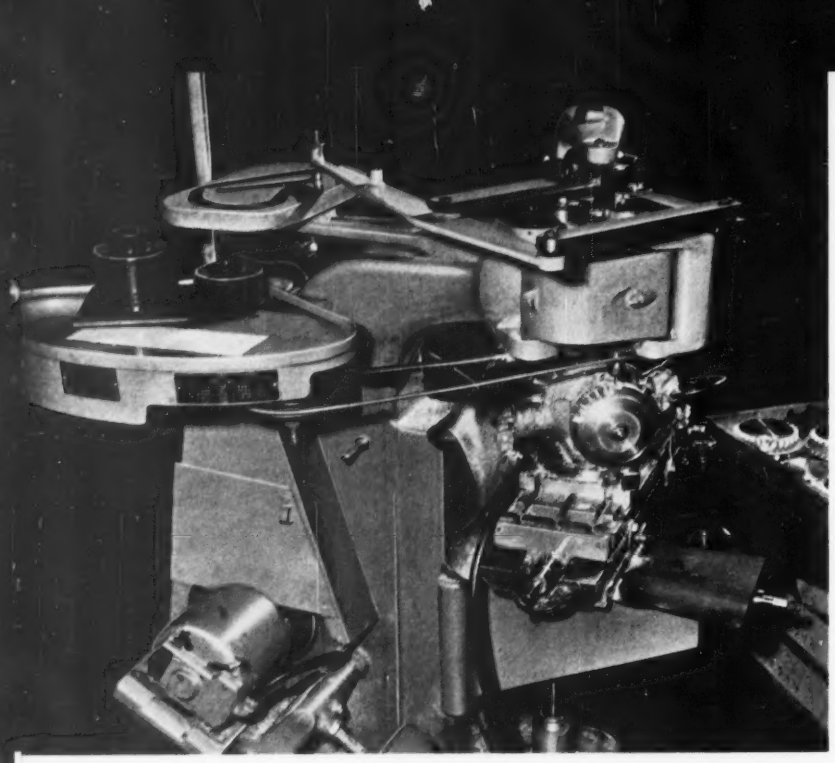


Fig. 9. Automatic pantograph engraving machine with motorized chain-driven master for milling vanes on aluminum impellers and turbine wheels

cross-feed is adjusted by a second valve, and the mechanical longitudinal feed is automatically stopped by a hydraulically operated clutch and brake mechanism, controlled by the tracer head.

Precision airfoil contours on the aluminum-alloy impellers and turbine wheels for the aircraft refrigeration units are profile-milled on specially modified Gorton pantograph engraving machines. Both manually operated and automatic profiling machines are employed for this operation. One of the automatic pantograph machines can be seen in Fig. 9. These machines are equipped with a motorized chain-driven master, and automatic feed and indexing, so that one operator can attend three machines. All vane surfaces on the size work-piece illustrated can be completed in thirty minutes on an automatic machine, compared to one hour on a manually operated machine. More than ten hours per part was required with previous methods.

On the automatic pantograph machine, an endless chain runs in a ground slot on top of the copy table, powered by its own motor. The slot—actually the master—is of the required airfoil contour, but is twenty times larger than the size of the vane to insure accuracy and to provide curves large enough for free movement of the motorized chain drive. The stylus, accurately guided in the slot, is pulled smoothly around the master, thus automatically milling the required vanes from the solid work-piece. Vertical cutter feed is cam-operated and controlled. The holding fixture on which the work-piece is mounted is automatically indexed the required number of

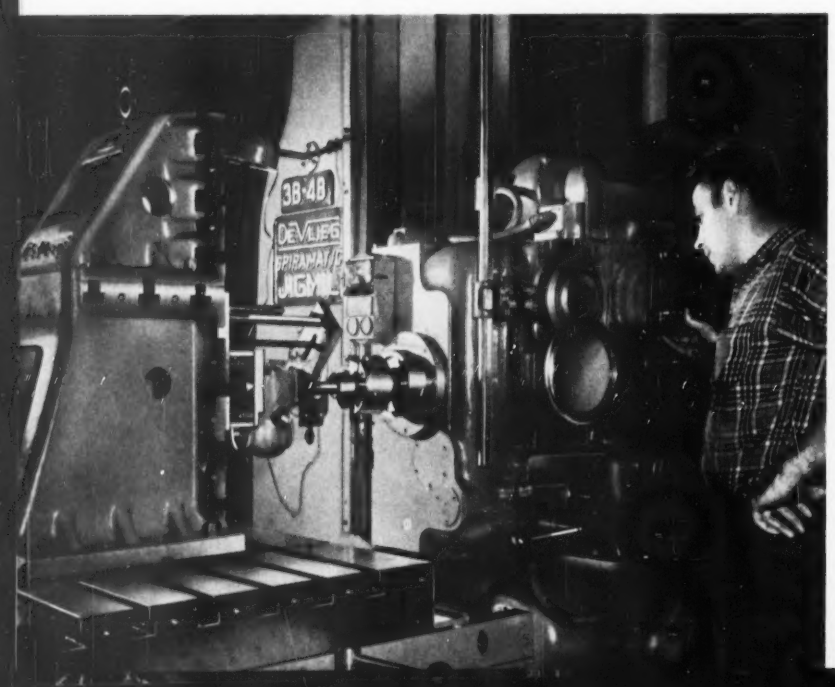


Fig. 10. Horizontal boring mill equipped for automatic speed changes and positioning of machine slides eliminates need for jigs and fixtures.

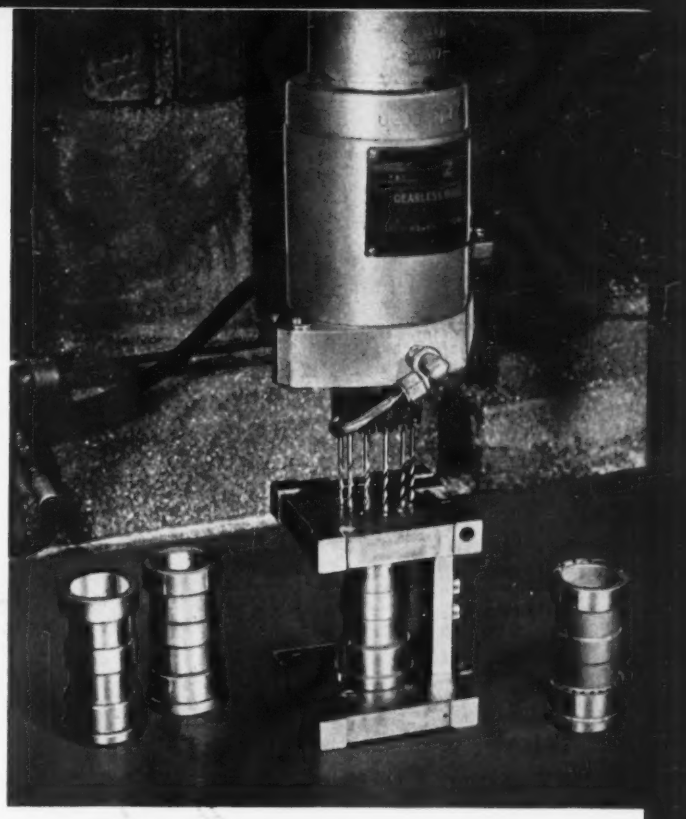


Fig. 11. Twelve holes 3/32 inch in diameter, spaced equally around a bolt circle of 1 1/2 inches, are drilled in one operation with this multiple-spindle gearless head.

times and the machine is stopped at the end of the cycle.

Extremely accurate drilling, boring, and facing of cast-aluminum housings for the aircraft refrigeration units is obtained without the need for jigs and fixtures by employing the De-Vlieg "Jigmil" shown in Fig. 10. On this machine, the spindle bar feed unit is provided with an automatic trip mechanism for stopping the feed at any pre-set location, thus accurately controlling depths when counterboring or facing. A rotating turret bar on the machine has twelve adjustable stops; when a projecting contact arm on a trip unit comes in contact with any of the stops, the feed is stopped instantaneously.

Changes in pre-selected spindle speeds on the horizontal boring mill are carried out automatically through the operation of a single push-button. Also, positioning of the machine table and spindle head in both the horizontal and vertical planes is performed automatically. This is accomplished by means of an electrically controlled cycle and measuring or locating rods, which arrest the motion of the slides and control hole spacing in the work-piece within 0.0001 inch. An electrically operated mechanism for locking and releasing the cutting tool permits quick changes without disturbing previous settings.

Closely spaced, small-diameter holes in the bearing cartridges for the aircraft refrigeration units are drilled simultaneously by means of Zagar gearless, multiple-spindle drill heads such as the one seen in Fig. 11. In the size cartridge illustrated, twelve holes 3/32 inch in diameter and 1 1/4 inches deep, on a bolt circle of only 1 1/2 inches, are drilled in one end of the part in one operation. The fixed-center drill head can be mounted on any standard drill press.

Since parts of some refrigeration units rotate at speeds up to 80,000 R.P.M., precision dynamic balancing is required to attain minimum vibration and maximum operating life. Dynamic balancing is accomplished on the machine shown in Fig. 12, which automatically determines the position and magnitude of unbalance on either individual parts or sub-assemblies. Corrections are made by drilling while still in the machine.

In the final testing of the refrigeration units, all conditions to which the accessory may be subjected during actual operating conditions are simulated. Units are tested at temperatures as low as 65 degrees F. and with air heated up to 800 degrees F., with pressures from 3 inches of mercury to 300 pounds per square inch. Batteries of test cells having complex indicating and recording instruments are used for the tests.

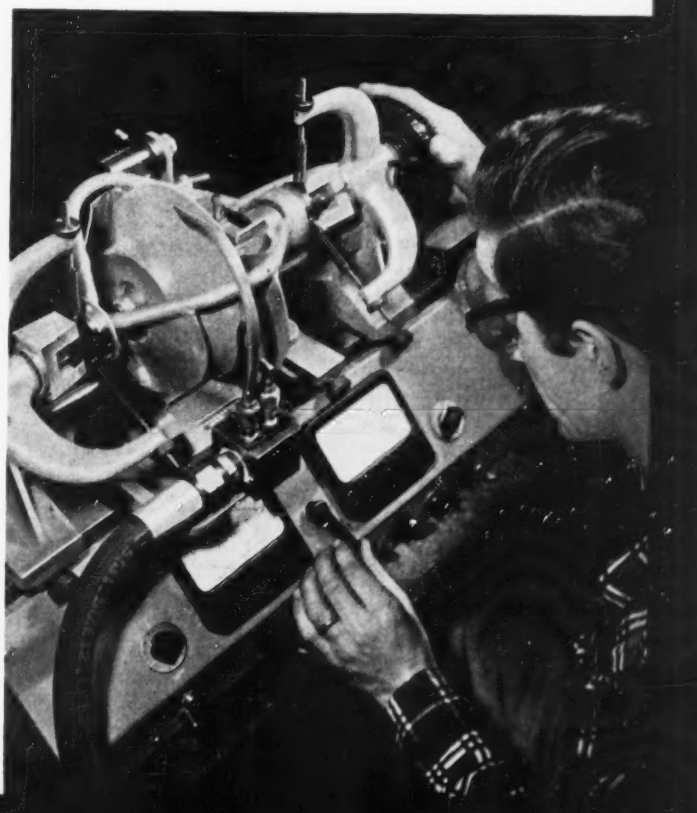
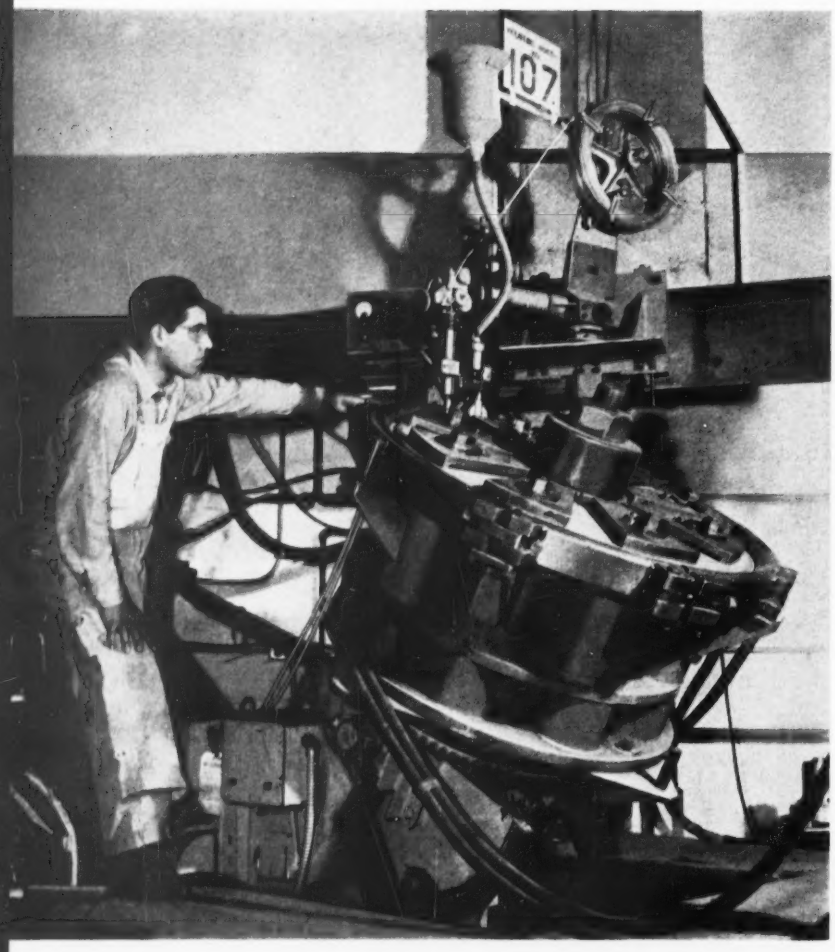


Fig. 12. Magnitude and location of dynamic unbalance are automatically determined on this machine. Corrections for unbalance are subsequently made by drilling.

Shielded-Arc Techniques



A prominent airframe and engine parts fabricator, long considered an authority on modern production welding, draws from its own experience in evaluating three important shielded-arc techniques

A REVOLUTION in fusion welding has taken place at the Ryan Aeronautical Co., San Diego, Calif. During World War II, thousands of aircraft and engine components were welded with acetylene gas, atomic hydrogen, or a shielded arc. Today, the only member of this team remaining is the shielded arc—all acetylene gas and atomic hydrogen production facilities having been converted to this technique. With the company's 169 fusion welding stations consuming more than 2,000,000 cubic feet of inert gas a year, it is one of the nation's largest users of shielded-arc welding.

Of the three types of shielded-arc welding, two have a shielding agent of inert gas, either helium or argon. The principal point of distinction between them is that one type employs a non-consumable tungsten electrode, and the other a consumable wire electrode. The third type is submerged in a granular flux and uses a consumable wire electrode. In each instance, the shielding agent serves to protect the hot electrode and weld metals from the oxidizing effects of the atmosphere. Although this oxidation can be tolerated in many industrial welding applications, it is thoroughly undesirable in aircraft structures. In jet, rocket, and piston engine parts, oxidation produces a brittle, porous structure with reduced strength and corrosion resistance. Continually subjected to cyclic extremes in heating and cooling, these components must be joined by top quality welds. Shielding is essential when welding all structures made of aluminum- and magnesium-alloy.

Inert-Gas Shielded-Tungsten Arc Welding

Inert-gas shielded-tungsten arc welding is similar to atomic hydrogen welding in that it makes use of a gas for protecting the hot metal.

Dominate Ryan Fusion Welding

Unlike the atomic hydrogen process, however, the arc is maintained between a single tungsten electrode and the base metal instead of between two electrodes. In addition, the blanketing gas, which flows in a low-velocity stream around the electrode, is inert and monatomic. This gas serves only as a shielding agent and does not dissociate to release additional heat as does hydrogen.

The arc is quiet and electrode consumption extremely low. Filler rod may be added by simply feeding wire into the arc. Either alternating current or direct current is used, depending upon the materials being joined. Both argon- and helium-shielded tungsten display a marked polarity, or rectifying quality. When used with direct current, this causes unequal heating at both ends of the arc. With straight polarity, the electrode is negative and operates cool, and the work is hot, a practice desirable for most metals. For use with aluminum, magnesium, or beryllium copper alloys, however, reverse polarity must be employed, in which the electrode is positive and operates hot with the work cool.

Features of the shielded-tungsten arc are as follows: flux is eliminated, welding speed and quality are high, and the bead laid down requires very little finishing. Since aluminum and magnesium alloys are attacked by the corrosive elements of flux, by eliminating its need they can be fusion-welded successfully. More latitude in welding design is possible because some joints are certain to entrap flux and often its removal is impossible.

Full penetration with speeds as high as 40 inches per minute can be attained on 1/16-inch stock. The pin-point concentration of heat that the technique provides, coupled with its speed, makes it exceptionally useful for welding stainless steels. These alloys are subject to carbide precipitation and loss of corrosion resistance when exposed to sustained welding temperatures. Also, the stabilizing quality imparted by the presence of columbium and titanium in some grades of stainless steel may be boiled away if the metals are held at welding temperatures for prolonged periods.

Undoubtedly, the narrow band and high-speed heating characteristics of the shielded-tungsten arc have made possible the welding of the "super" alloys used in jet engines. Inconel X and W, and Stellite 25 and N-155 are extremely susceptible to cracks at welding temperatures because of their poor thermal conductivity and high coefficients of expansion. Unshielded welding techniques poured heat into these alloys faster than it could be conducted away from the weld zone. As a result, an extreme temperature

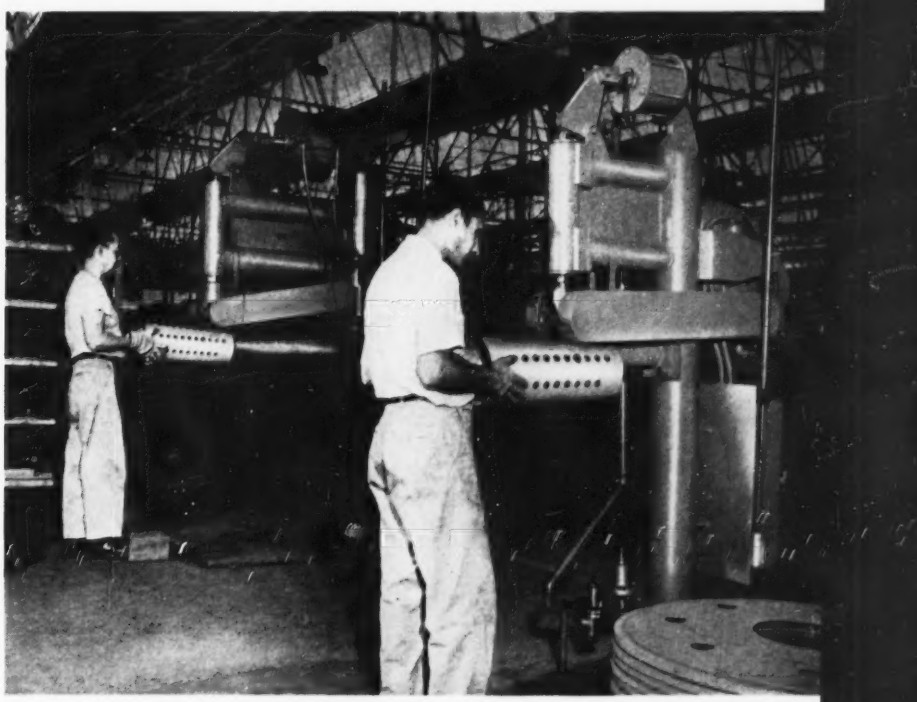


Fig. 1. Seams are rapidly flattened and refined on these company-built rolling machines. Rolling also eliminates the notch effect caused by the tendency of the metal to sag slightly when molten.

differential was established between the hot and cold portions of the sheet, and severe stresses were set up.

The shielded-tungsten arc proves efficient for welding practically all of the commercial metals. It produces X-ray quality welds that possess good tensile strength, elongation, and impact resistance. The high speed of the process makes it ideal for welding light-gage materials because of negligible warpage and better-looking welds. At Ryan, the shielded-tungsten arc is used for gage thicknesses from a single sheet of 0.035 inch to two sheets of 0.156 inch.

Because of the stabilizing effect of the blanketing gas, the weld deposit is laid down in a smooth bead without sputter or splash. Consequently, the weld seldom requires the grinding or finishing operations which are associated with other fusion-welding operations. This is a distinct advantage in reducing production time.

All shielded-tungsten arc butt welds in austenitic steels are performed without the addition of filler wire. Afterward, these welds are seam-rolled in company-designed seam rollers, such as those shown in Fig. 1. Specially built for this work, the machines flatten the weld seam between two steel rolls under heavy pressure. This cold-works the weld to refine its structure and eliminates the notch effect caused by the tendency of the metal to sag slightly when molten.

All exhaust systems are fabricated with this welding technique. These structures are found on many aircraft, and on medium tank engines as well. They are fabricated from Inconel and stainless steel. Gages run from 0.042 to 0.095 inch. Because of their complex and irregular design, they are welded manually.

Here, the shielded-tungsten arc is ideal, since some torches weigh as little as 3 ounces. The operation is performed in twenty-nine integrated welding booths, seen in Fig. 2. All motor-generators are installed overhead and a cascade system is used to supply argon gas and cooling water. Company-developed timers automatically control the flow of both gas and water.

For these tasks, direct current with straight polarity ranging from 75 to 100 amperes is used. Material thicknesses differ in the designs, and the welder uses a Mullenbach foot control rheostat to vary the welding voltage as he proceeds. This gives him better control over the welding operation. Instead of adding filler metal to these welds, an upstanding flange is formed at the seams and melted down by the heat of the arc.

Manual shielded-tungsten arc welding is employed for a variety of detailed components for jet engines. These run the gamut of special alloys, such as Inconel, Inconel X and W, Stellite 25 and N-155, Discaloy, and the stainless steels. In jet-engine work, the dimensions of the weld are specified and tolerances in width must be closely controlled.

In addition to the high-temperature alloys, many aluminum alloys are welded with a manually controlled shielded-tungsten arc. A typical

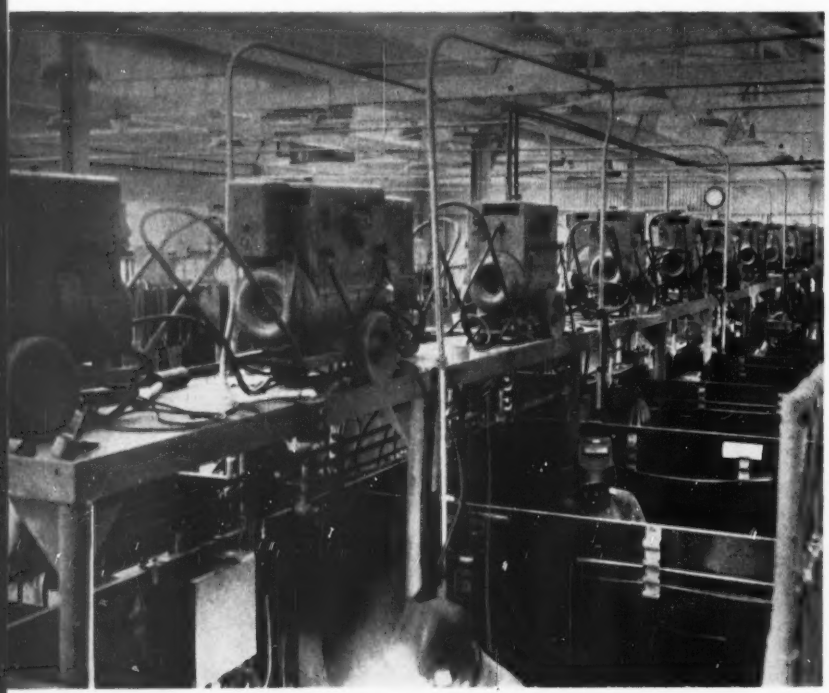


Fig. 2. Aircraft engine exhaust systems are welded in these booths. The unique arrangement of overhead machines and automatic gas and water control has substantially increased production.

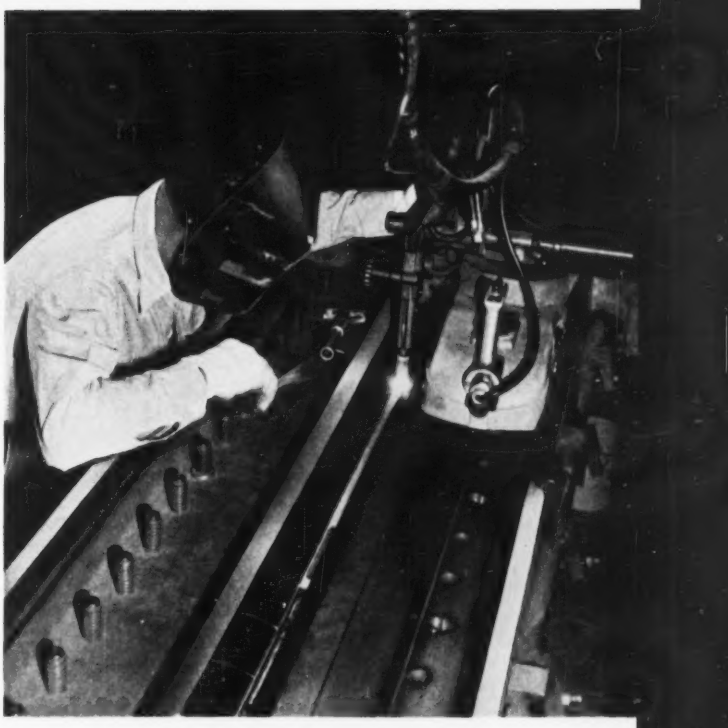


Fig. 3. Operating at 30 inches per minute, a shielded-tungsten arc-welding machine fuses the seam of a stainless-steel tail pipe for a jet engine. Ryan employs welding machines and special fixtures for a variety of straight-line operations.

example is the welding of huge rings, 4 feet in diameter. These rings serve as splice joints for some of the largest external fuel tanks ever built for aircraft. They are fabricated from 61S aluminum alloy. A high-frequency, stabilized alternating current between 75 and 150 amperes is used. Gages vary from 0.050 to 0.072 inch. The torches are the same as those employed in welding stainless steel.

With a special Linde pistol type torch, it is possible to make automatically timed spot welds that are exceptionally useful in certain production jobs. Because the spot-welding can be completed from one side of the structure, the parts do not need to be removed from their fixtures. The technique is valuable where several components must be aligned in a precision fixture and spot-welded in place.

Ryan has constructed a mobile machine that incorporates all of the necessary elements for spot-welding—a direct-current generator, a supply of argon gas, a 40-gallon water tank, and a pump. The unit can be quickly moved along the production lines to the work. It is used to spot-weld Fairchild C-119B exhaust hoods and machined rings in assembly jigs. After these parts are carefully fitted together and spot-welded, they are seam-welded in resistance welding machines. The spot-welding torch produces such a smooth deposit that no finishing is necessary before running these parts between the wheel electrodes of the resistance welders.

Besides the large amount of manual welding carried on, considerable automatic shielded-tungsten arc welding is performed. Automatic machines are used on all straight-line, butt-welding jobs, both in aluminum alloys and stainless steels. For instance, afterburners, tail pipes, and exhaust cones for General Electric J-47 jet engines are fabricated in this way.

In Fig. 3 is shown an automatic set-up for welding the tail pipes of these engines. A special fixture holds the part in exact alignment while the automatic welding head traverses the longitudinal seam. Direct current with straight polarity is used and speeds up to 30 inches per minute are attained. Some machines are equipped with selenium type rectifiers which convert alternating current from the line into direct current and eliminate the motor generator.

All of the longitudinal seams in the huge fuel tanks made by the company are welded automatically. The large sections of the tanks are butt-welded with filler wire fed into the seam. The tanks are made of 61S aluminum, and gage thicknesses run from 0.051 to 0.072 inch. With an Airco floating head that maintains an arc of constant length, it is possible to weld contoured surfaces. A machine incorporating such a head is used to weld the irregular contours of afterburner nozzles.

One of the newest devices is a Linde semi-automatic HWM-1 welder, illustrated in Fig. 4. This is a manually operated torch that automatically feeds the filler wire. The operator only has to adjust the current and wire feed, and then guide the work. When the arc is struck, the wire starts to feed between rolls into the weld. Its movement propels the torch. Hand welding speeds as high as 80 inches per minute have been reached with this new device. Combining the advantages of manual guidance with automatic control of arc length, wire feed, and travel, the technique is excellent for irregular components. It is water-cooled and handles up to 300 amperes.

Argon gas is in more general use than helium. Basically this is because argon can be obtained commercially in higher purity and is more efficient for most of the shielded-tungsten arc-welding tasks. Being ten times heavier than helium, argon can flow down over the welding area more readily, and much less is consumed. Arcs shielded by argon have lower voltages than those shielded by helium, thus permitting the use of higher currents without burning the work. Both

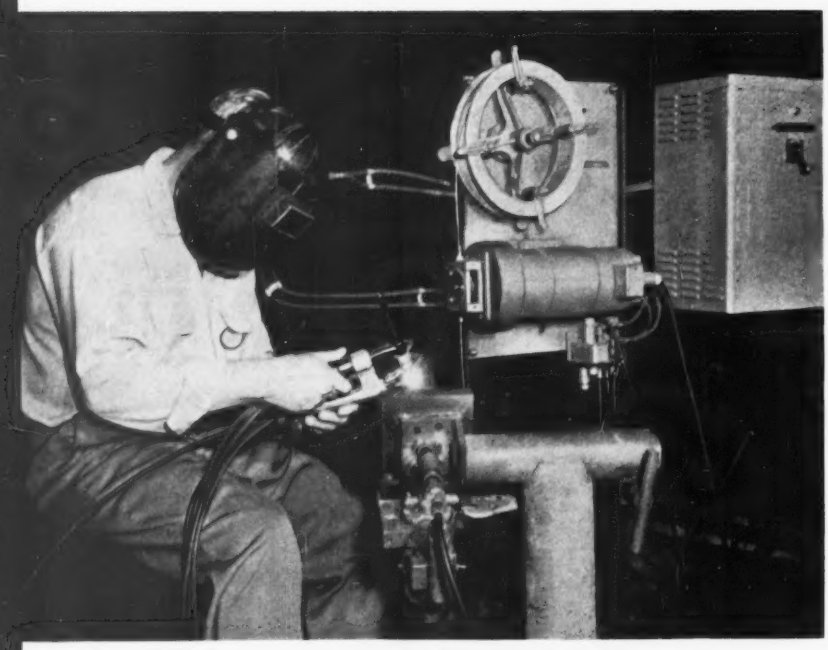


Fig. 4. In a new shielded-tungsten arc-welding method, the wire is automatically fed between motor-driven rolls into the arc, while the torch is controlled manually.

lower voltage and increased current contribute to improved arc stability. Ryan does use helium, mixed with argon, for all welding of aluminum alloys, because the heat of helium is greater for a given current than that of argon, and penetration is deeper.

Inert-Gas Shielded-Metal Arc Welding

For speed in welding, inert-gas shielded-metal arc welding—popularly referred to as sigma welding—makes other types look slow. This amazing method has been clocked at 200 inches per minute with 1/16-inch material. Even in 1/2-inch plate, structural welds can be made at 48 inches per minute.

In sigma welding, a consumable wire electrode is fed at high speed through a blanket of argon gas and melted into the weld area. Like the shielded-tungsten arc, it produces high-quality welds with deep penetration, and lends itself to automatic operation. Sigma welding can handle twice the current densities used with the shielded-tungsten arc. Ryan uses sigma welding to join exhaust-system nipples to port flanges and ball sections to exhaust tubes. These components are about 2 1/2 inches in diameter and are welded circumferentially.

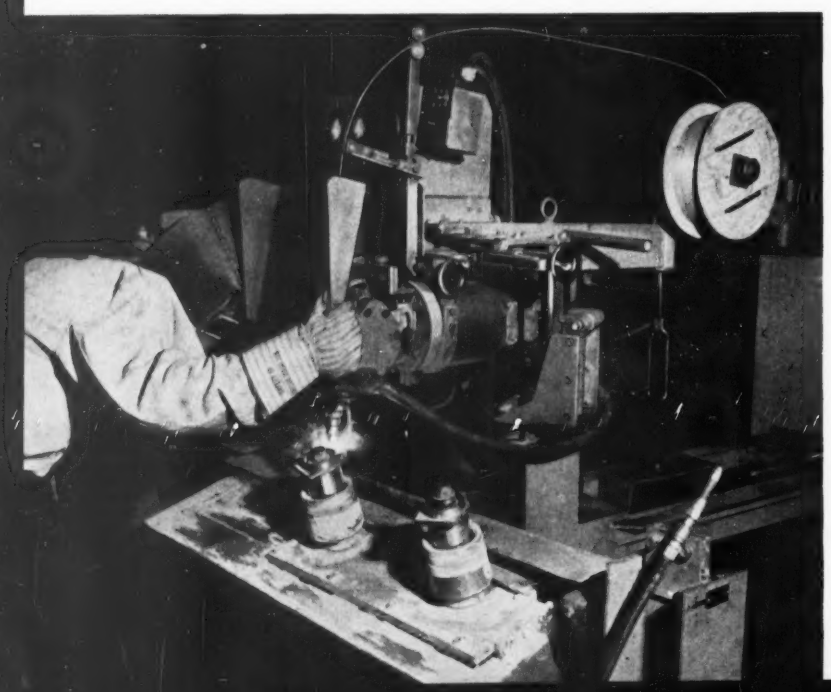


Fig. 5. An electronic eye controls the cycle time of this sigma-welding operation. Machine uses a fast-shift carriage.

For welding the nipples to the flanges, a new machine has been devised that is phenomenal in its effectiveness. This welder, shown in Fig. 5, is a Linde FSM-1 type powered by a Lincoln 400-A motor-generator. It is mounted on a fixture having a sliding carriage with two revolving holders that turn at constant speed. Each holder is a small expanding mandrel that firmly retains the nipple during welding and quickly releases it when contracted. The carriage moves back and forth through an 18-inch travel to bring the nipples directly under the electrode of the sigma welder.

After the operator places the work on one of the revolving holders, he presses a pedal. The carriage shifts to bring the nipple under the electrode. As it moves, the carriage trips a micro switch which starts the welding cycle, and the arc strikes. Direct current of 250 amperes is used with reverse polarity. The light of the arc plays upon a photo-electric cell, tripping a relay that automatically times the welding run and switches off the arc. All the operator does is shift the carriage and replace the nipples. While one holder is in work, the other holder is being unloaded and reloaded.

Formerly, each nipple required three minutes of manual welding and also finishing time. With the new machine, it takes only seven seconds to obtain a sound, clean weld that requires no finishing. A normal production rate for this machine is 800 nipples per eight-hour shift, although as many as 1200 have been turned out in that period.

Submerged-Arc Welding

The submerged-arc welding technique is similar to sigma welding, also employing a consumable electrode and permitting the use of high-current densities. It differs in that the shielding agent is not a gas but a dry, granular flux that flows down over the weld area. In melting, the flux forms a fused slag that blankets the weld, but which is subsequently easily removed. Excess flux that does not melt is re-used.

The arc is invisible, and the operation quiet and smooth. Since high-density currents are permitted, large electrodes can be used and heavier welds laid down in single passes. For this reason, the submerged arc is used to weld heavy-gage materials. The technique is particularly adapted to straight-line work. Automatic machines can weld metals 3 inches thick in a single pass, and can attain a speed of 200 inches per minute on light-gage materials.

Typical of submerged-arc work is the fusing of a large heavy-gage circular burner plate to a flange. Part of the aft frame of General Electric J-47 jet engines, the burner plate is 0.125 inch thick and the flange is 0.075 inch thick. Both components are fabricated from 321 stainless steel. In the heading illustration is shown a view of the operation. A Worthington weld positioner rotates a special fixture holding the work. Filler wire of 29-9 composition is added to the weld. The 1/8-inch fillet weld produced is completed in one pass at a speed of 55 inches per minute. The fixture was built by Ryan.

* * *

Heavy-Duty Thrust Bearing

A new bearing designed for use on railway transfer bridges and other high-capacity industrial loadings is being manufactured by the Rollway Bearing Co., Inc., Syracuse, N. Y. This bearing is capable of supporting a vertical thrust load of 380,000 pounds at 16 R.P.M., and has a rated capacity of 700,000 pounds.

An interesting feature is the method of locating the roller assembly. No center shaft is used; instead, a locating ring, which is roll-pinned securely to the stationary plate, maintains the alignment of the roller assembly. The heavy-duty thrust bearing can also be used where the shaft is in a horizontal position.

A locating ring replaces the conventional center shaft for locating the roller assembly in this thrust bearing.

How Position Tolerances Affect Gaging Requirements

Part II

Tolerances are established to control variations in size, form, position, and function. In this tenth of a series of articles on dimensions and tolerances for mass production, the author shows how tolerances on position are selected and how they determine the gaging requirements

By EARLE BUCKINGHAM
Professor of Mechanical Engineering
Massachusetts Institute of Technology

Plug Gages for the Holding-Pin Holes

The diameters of the three holes, 0.500 inch in diameter, for the holding pins whose positions are in the A group, are inspected with limit plug gages of conventional design. As these holes go entirely through the shell of the housing, progressive limit plug gages can be used here for rapid inspection. The diameter of the GO end is 0.500 inch, plus gage tolerance and wear allowance, while that of the NOT GO end is 0.505 inch, minus gage tolerance. The position of these holes, which was shown in Fig. 7 (see February MACHINERY, page 186), has already

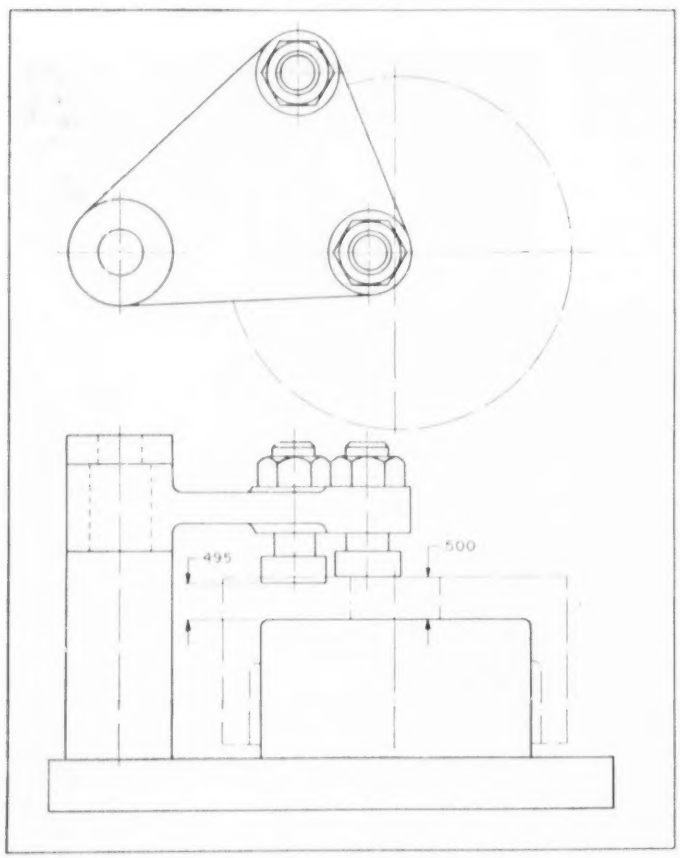


Fig. 12. Swinging arm gage for checking the wall thickness at the bottom of the chuck housing

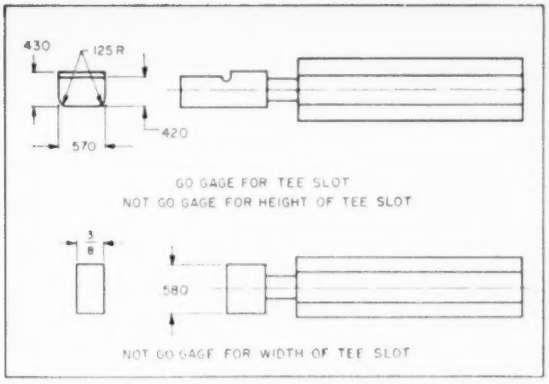


Fig. 13. Limit plug gages used to check the bottom of the T-slots in the chuck housing. The gage at the top is a GO gage for the width of the slots and the form of the bottom of the slots, and has a NOT GO step for the height of the slot. The NOT GO gage at the bottom is for the width of the slots.

been checked with the positional gage illustrated in Fig. 8 in the same article.

The B group of dimensions relates to the assembly of the three jaws in the face of the housing. The thickness of the wall at the end of the recess in the housing belongs as much to this group as to any other. This dimension can be checked by any one of several types of swinging-arm gages. Some of these use dial indicator gages to measure the thickness or variation in thickness. As the amount of the tolerance in this case is 0.005 inch, a swinging arm gage with two steps can be used as shown in Fig. 12. The steps on the swinging arm are made adjustable to permit compensation for wear in service. The GO step is adjusted to a distance of 0.500 inch above the registering surface on this gage and the NOT GO step is adjusted to a distance of 0.495 inch above this registering surface. Setting blocks of these sizes are provided for use in adjusting this gage. In operation, the housing is located with the bottom of its recess resting on the registering surface of the gage. The gage arm is then swung over the front face of the housing. The GO step must swing over without interference while the NOT GO step must stop against the outside diameter of the housing.

Limit plug gages are provided to check the width of the three narrow slots in the face of the housing that control the position of the three jaws of the chuck. These may be cylindrical or flat gages, but flat ones are more satisfactory because they have greater wearing surfaces to resist wear. In addition, they may be of the progressive type in order to achieve more rapid inspection.

The gages for the bottom of the T-slots are shown in Fig. 13. These consist of a GO gage for the size and form of the bottom of the T-slots with an end comprising a progressive gage for the height of this bottom section. A separate NOT GO gage is needed to check the width of the section.

Because of the small tolerance involved, a dial indicator gage is required to check the position of the upper surface of the bottom section of the T-slot, measured from the datum surface at the bottom of the recess in the housing. This surface controls the axial position of the jaws. Such a gage is shown in Fig. 14, together with a test block or setting gage to adjust the dial of the indicator gage to zero. This gage consists of a frame, the end of which rests against the datum surface of the housing at the bottom of its recess. The frame carries a cylindrical spring plunger, the end of which rests on the upper surface of the bottom of the T-slot, and the dial indicator gage which registers the position of the gaging

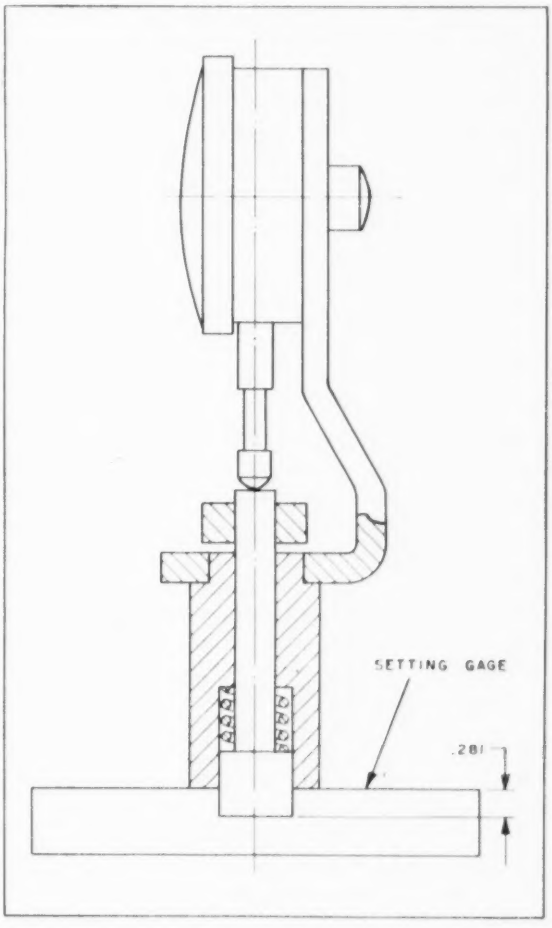


Fig. 14. Because of the small tolerances involved, a dial indicator gage is required to check the position of the upper surface of the bottom section of the T-slots in the chuck housing.

end of the spring plunger in reference to the locating surface of the frame of the gage. In operation, the gage is held against the datum surface of the housing with the gaging end of the spring plunger resting against the bottom of the T-slot. The hand of the dial indicator gage must be between zero, which is established by the setting gage, and the plus 0.002-inch mark.

A progressive limit plug gage is used to inspect the diameter of the clearance hole in the center of the face of the housing. The diameter of the GO end is 1.062 inches, plus wear allowance and gage tolerance, and the diameter of the NOT GO end is 1.072 inches, minus gage tolerance. This completes the gages for the B group of features.

The C group of dimensions relates to the assembly of the small bevel pinions that engage the bevel gear feature at the rear face of the spiral scroll. These bevel pinions act to rotate the spiral scroll to move the jaws when clamping and unclamping the work in the chuck. A progressive limit plug gage is used to inspect the holes in the shell of the housing, which retain the flanges of these pinions. The diameter of the GO element is 0.875 inch, plus wear allowance and gage tolerance, while that of the NOT GO element is 0.877 inch, minus gage tolerance.

This group also contains the three holes in the face of the housing for the bevel-pinion retaining pins, and the screws which keep these retaining pins in their axial positions. These holes have three diameters in addition to the threaded portion—the holes for the retaining pins which are also the tap drill size for the threads; the counterbores of the body size of the screws; and the counterbores to receive the heads of the retaining screws. Separate sets of plug limit gages can be made for each diameter, or a composite GO gage can be made for all three sizes with a separate NOT GO gage for each size.

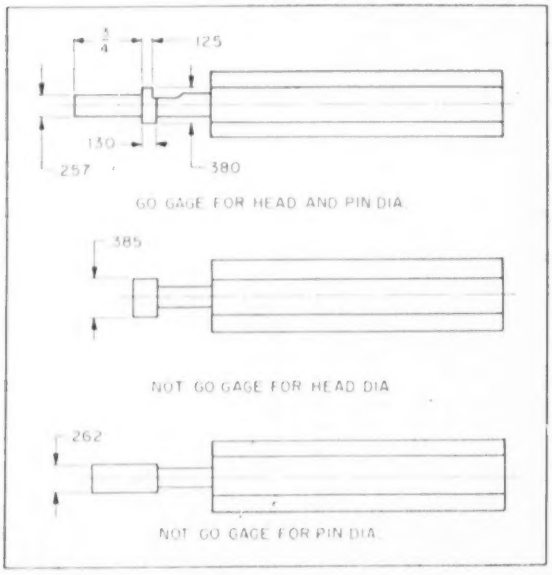


Fig. 15. Limit gages for the retaining-pin holes and the retaining-pin screw-holes in the chuck housing. (Top) Composite GO gage for screw-head counterbore diameter and tap drill diameter. (Bottom) NOT GO gages for counterbore diameter and pin diameter.

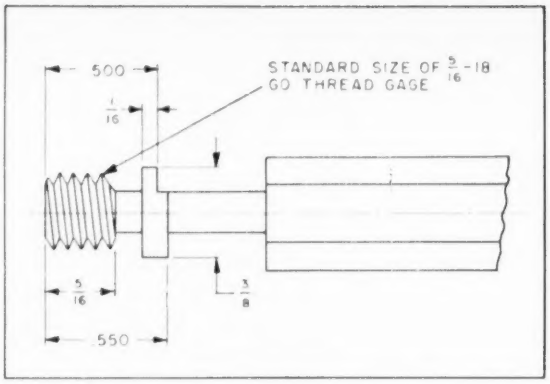


Fig. 16. Limit gage for the threaded portion of the retaining-pin screw-holes. This gage for the depth of the thread also serves as a GO limit gage for the thread itself.

If a composite GO gage is used to facilitate inspection, this gage will contain only the screw-head counterbore diameter and the tap drill diameter. The end of this gage is made with steps to check the depth of the counterbore for the head of the screw. This gage is shown in Fig. 15. Separate NOT GO gages are provided for both of these diameters.

A separate GO gage is made for the body size of the screw. This gage also has steps at its end to check the depth of this counterbore, similar to that shown in Fig. 15.

Standard limit plug thread gages can be used for the threaded portion of each hole, but then a special gage must be made to check the depth of the threading in the hole. The gage for the depth of the threading may also act as a GO gage for the thread itself. This will make a single inspection operation for the size of the thread and its depth. A standard NOT GO thread gage will then be used. Such a special GO thread gage is shown in Fig. 16. This completes the gages for the housing.

Use of Positional Symbols for Alignment and Symmetry—Conditions of position also include the factors of alignment, straightness, symmetry, and the angular relationship of one plane surface in reference to another. Some of these factors have already been treated in previous examples. To complete the discussion, however, they are included here, even at the risk of repetition.

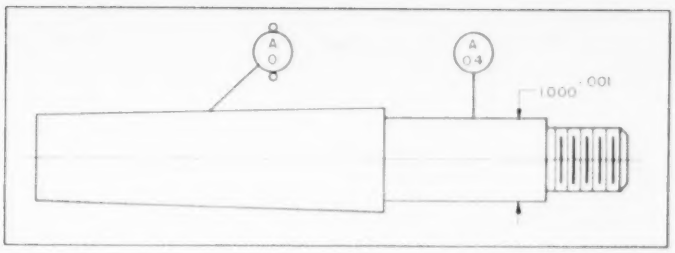


Fig. 17. The amount of eccentricity of the cylindrical shaft extension of this tapered shank must be held to the specified minimum amount, regardless of the size of the several features. The permissible amount of eccentricity is indicated by using the positional symbols shown.

The accuracy of the alignment, or the maximum permissible eccentricity of several shoulders on a shaft in respect to one another, is specified by the use of the positional symbol. One surface is selected as the datum while the others have positional symbols specifying the maximum run-out permitted on each shoulder. In such cases, a positional gage is provided. Here, as in all other positional conditions, the tolerances on the sizes of the several features are ignored in the positional inspection. The positional gage

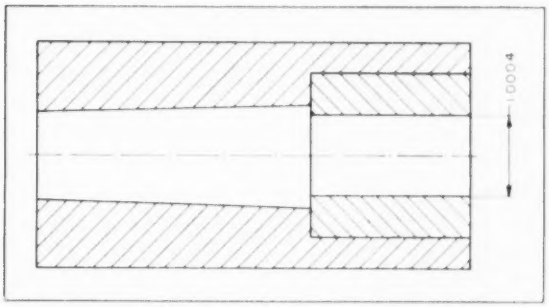


Fig. 18. Position gage for taper shank seen in Fig. 17. This gage consists of a tapered ring gage with a cylindrical recess to receive the second part, which consists of a cylindrical ring gage for shaft extension.

sizes are established from the maximum metal limit sizes of the several features. Hence, the actual amount of eccentricity can be greater than that specified by the positional symbols and tolerances, on parts or features whose sizes are toward the minimum metal limit sizes. Such alignment positional gages are used to check for conditions of assembly. When the operating or functional conditions of eccentricity must be controlled directly, positional gages are not used. Direct measurements must then be made.

When the amount of eccentricity must be held to a specified minimum amount regardless of the exact size of the several features, then the letters *MEAS.* are inscribed below or near the positional symbol, together with any further qualifying notes which may be needed to express the required functional conditions clearly. In such cases, the component is rotated in a V-block which supports the datum surface, and a dial indicator gage is used to measure the amount of the run-out of the other surfaces. The run-out is double the amount of the eccentricity.

Positional Symbols Applied to Shaft Alignment—One example of such a condition of alignment is that of the cylindrical shaft extension of a tapered shank, as shown in Fig. 17. Usually, an actual measurement of such a construction is necessary because of the functional operation. However, for the sake of the example, it is assumed that the assembly conditions are the most important.

In this example, the datum surface is that of the tapered shank while the shaft extension has a positional tolerance of 0.0004 inch. The gage for this component consists of two parts. One is a tapered ring gage with a cylindrical recess to fit and receive the second part which consists of a ring gage, 0.0004 inch in diameter larger than the maximum metal limit size of the shaft extension. The outside diameter of the ring gage fits the cylindrical recess of the tapered ring gage. and must be concentric with its bore. This gage is shown in Fig. 18.

In operation, the tapered shank of the component is seated in the tapered ring gage, and then the plain ring gage is assembled over the shaft extension and slid into position in the recess at the end of the tapered ring gage. These units must assemble together over the component without any forcing.

Positional Symbols Applied to Slot Alignment—One common problem of symmetry is that of a slot, or tongue, in relation to some other central feature. A typical example is that of a slot in the end of a valve push-rod which receives the roller that acts against the cam on the camshaft of an internal combustion engine, as shown in Fig. 19. Here the outside diameter of the push-rod is the datum surface and the positional tolerance is specified as 0.002 inch.

The positional gage for this feature of the push-rod is a cylindrical ring gage of reasonable length, with the diameter of its bore equal to the maximum metal limit outside diameter of the push-rod. The gage has a flat insert, or key, 0.002 inch thinner than the maximum metal limit width of the slot. The key is accurately centered

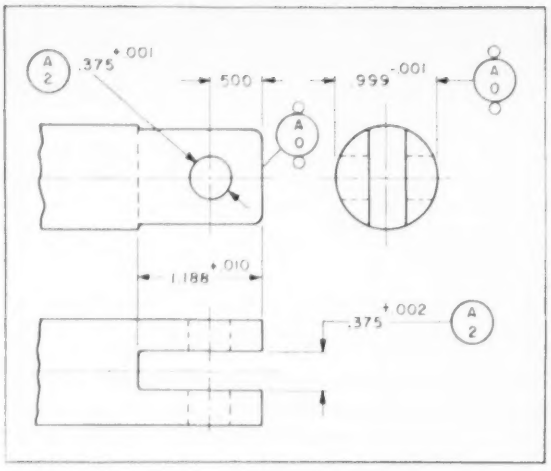


Fig. 19. The position of the slot in the end of this valve push-rod relative to the other features of this part presents a common problem in alignment.

with the bore and assembled into the end of the ring gage. Strictly speaking, the length of the ring gage might be equal to the length of the push-rod. Such a design, however, would involve a test of the straightness of the push-rod. For all practical purposes, the length of the ring gage should be from two to three times the diameter of the push-rod. Such a positional gage is shown in Fig. 20. In operation, the push-rod is assembled into this ring gage and rotated until the slot engages the flat key. An acceptable component must assemble into this gage without forcing.

The position, including the squareness, of the hole for the axis-pin for the roller is also involved here. The positional symbol and tolerance shown near the dimension for the diameter of this hole cover this condition. A hole is provided in the positional gage, accurately positioned, which is 0.002 inch smaller than the maximum metal limit diameter of the hole in the end of the push-rod.

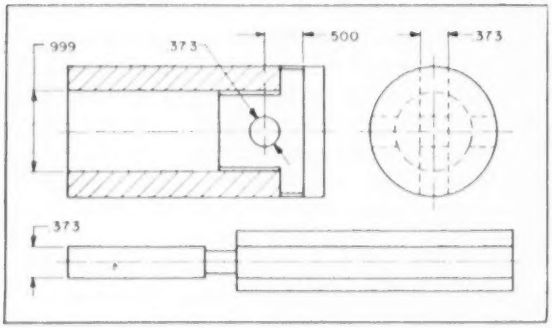


Fig. 20. Positional gage for the valve push-rod in Fig. 19. It consists of a cylindrical ring gage of reasonable length with the diameter of the bore equal to the maximum metal limit outside diameter of the push-rod and having a flat insert or key.

A plug gage, also 0.002 inch smaller than the maximum metal limit diameter of the hole in the push-rod, is provided as well. When the push-rod is assembled into the gage, this cylindrical plug gage must pass through the gage and component without forcing.

Positional Symbols Applied to Angular Alignment—The specification of a tolerance on the angle or squareness of a plane surface in reference to some other datum surface sometimes proves to be a very perplexing problem. In the final analysis, it must be specified in terms of its method of measurement, either directly or by implication. For a flange and its bore, or a flange and its shaft, the amount of run-out permitted is specified by the use of the positional symbol. Such conditions are generally measured by means of a dial indicator gage applied near the outer edge of the face of the flange. In such cases

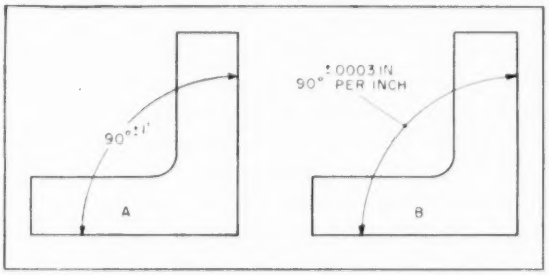


Fig. 21. Two methods of specifying an angular tolerance between two surfaces: (A) by indicating a tolerance on the angle itself; and (B) by indicating a tolerance on the amount of taper of the surfaces.

the positional symbol carries near it the notation: *MEAS. AT EDGE.*

The permissible departure from squareness of two plane surfaces poses a different problem, both for the method of specifying the requirements and for testing the conditions on the component. The requirements are controlled by the functional conditions which must be met, and these may be many and varied. Often, in these cases the simplest and most direct solution may be the use of a functional gage. In such cases, a note to this effect must appear on the detail drawing. Then the conditions permitted by such a functional gage become an integral part of the dimensional or form specifications.

In some cases, a specific tolerance can be given on the value of the angle between two surfaces. This method is recommended by the S A E Automotive Drafting Standards. Such a tolerance may be specified as part of a degree of angle, as shown at *A* in Fig. 21; or it may be specified in a similar manner to the specification of a tolerance on a taper as shown at *B* in Fig. 21. In

either case, it is measured by the use of a sine square as shown on Fig. 22, or by its equivalent.

Positional Symbols Applied to a Series of Linear Dimensions—The simplest series of conditions of position to specify occurs when all of the conditions are taken from the same datum surface and, in addition, are in one direction only, such as the positions of successive shoulders on a shaft or the axial positions of successive cranks and bearings on a crankshaft. Here the method of expressing the dimensions and tolerances of position on the detail drawing can be the same as that for a dimension of size—namely, either the design distances are given with tolerances or the limiting distances are expressed directly. There is no reason, however, why the positional symbols may not be used here also. The positional symbol for the datum surface can be given, and positional tolerance symbols given at each distance or positional dimension.

The delineation of a series of dimensions of position, all from a common datum, will take considerable space on the detail drawing if common conventions of dimensioning are followed. An example of this is Fig. 23. The dimensions given here represent the axial positions of the cranks and bearings along the length of a crankshaft. To provide room for the dimensions and to keep the dimension lines clear of each other, the drawing must be greater than otherwise needed.

The practice now followed in the engineering department of one manufacturing plant is to indicate the common datum and then show only the start of the dimension line with a single arrowhead at the particular position. This practice can be followed with the use of positional symbols and tolerances, as shown in Fig. 24. The datum symbol is given at the common locating surface. Positional symbols and tolerances are indicated with all the dimensions of distance or position. In such cases, the positional tolerances are given with plus or minus signs, or both, as the conditions require. Here, if the differences

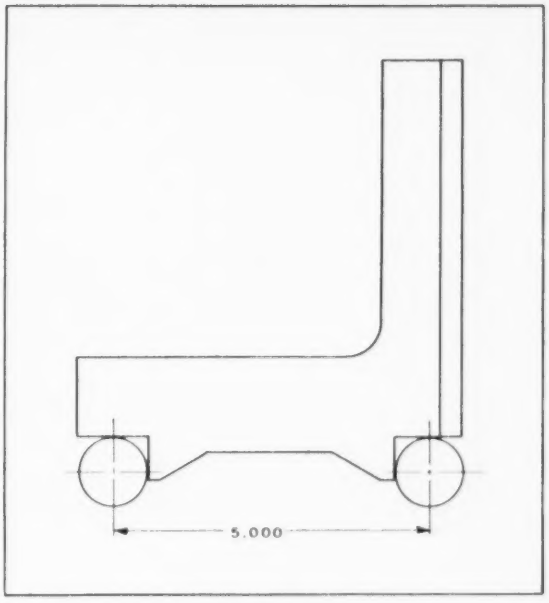
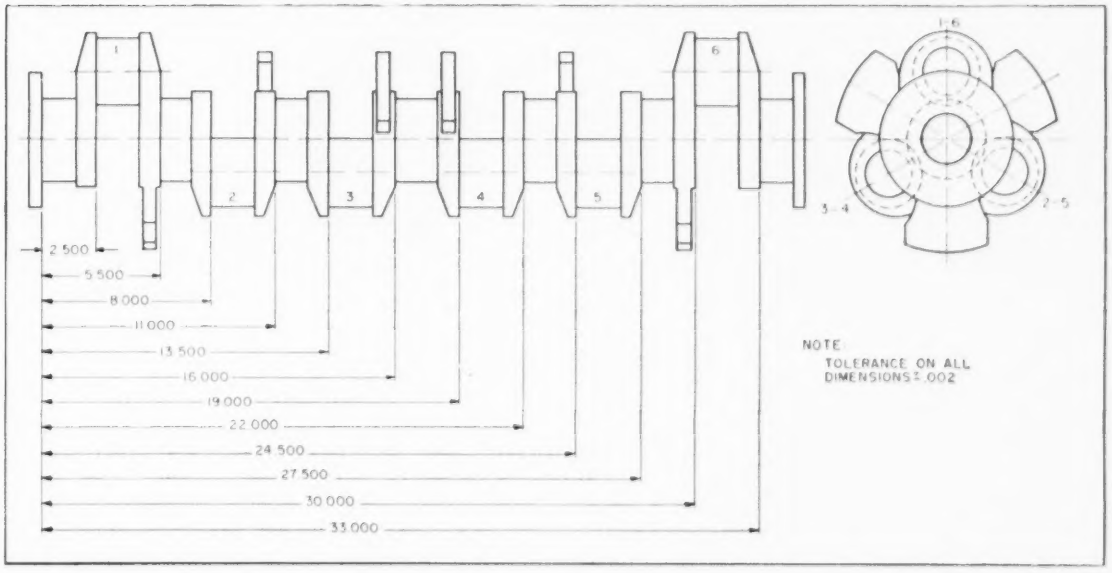


Fig. 22. Sine square employed to measure the angle between the surfaces of the square shown in Fig. 21.

Fig. 23. Positions of condition that are in one direction only, and from a common datum, are the simplest to specify and inspect. The positions of successive cranks and bearings on this crankshaft are all taken from a common datum.



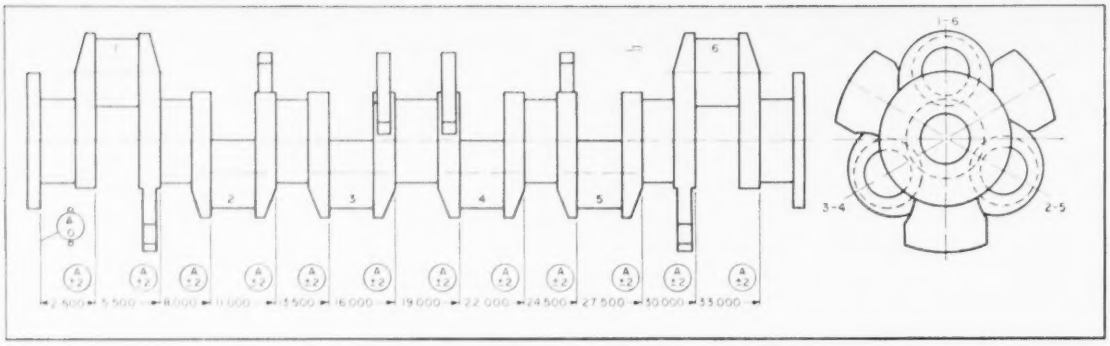


Fig. 24. The positions of condition of the crankshaft in Fig. 23 can be expressed by using positional symbols, here shown, with a considerable reduction in the amount of space required on the drawing.

in position are large enough, all these dimensions can be shown along one horizontal line. This practice conserves much space on the detail drawings, and makes the intent of the drawing clear. The design of the distance gages is the same in any case. There are many other opportunities to improve on conventional practices along similar lines.

Attention will next be given to the conditions that require the use of functional gages. In the majority of cases, the need of such functional controls becomes evident after the initial production activities have begun.

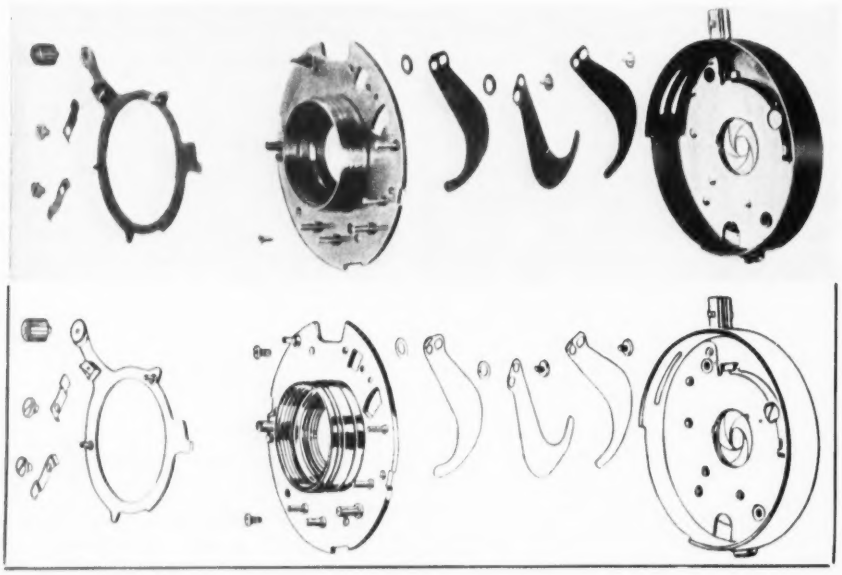
* * *

Booklet Explains the Conversion of Photographs into Line Drawings

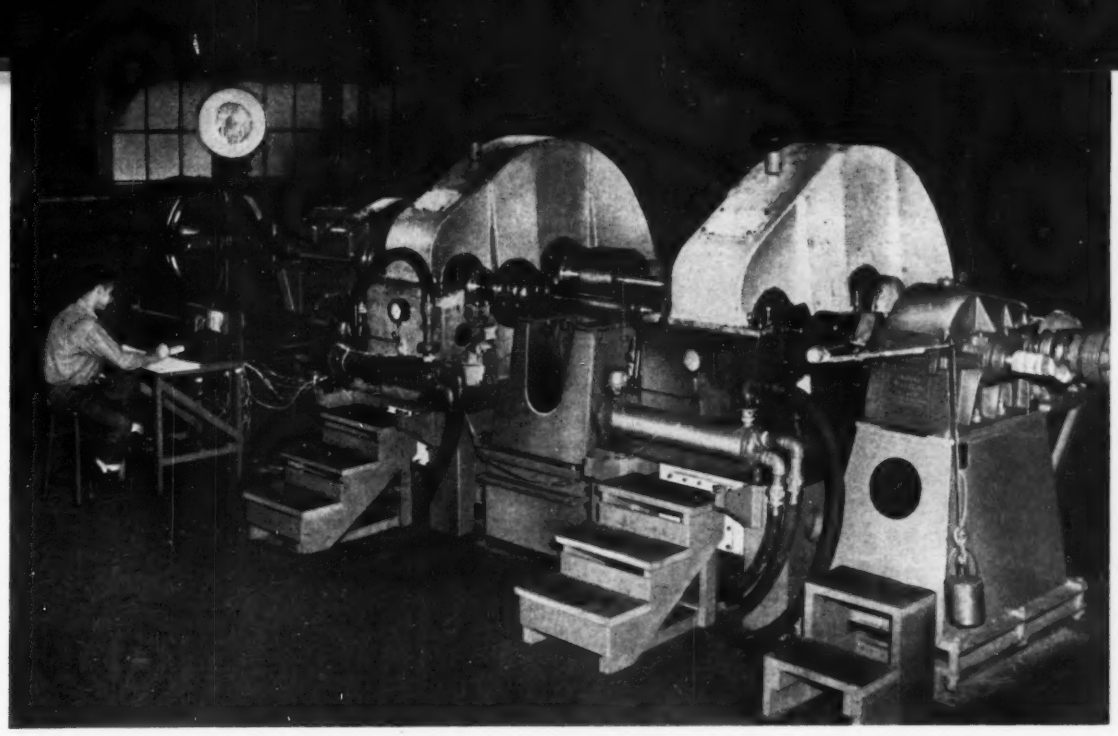
Techniques for photographically converting a continuous-tone image into a line drawing are described in a new booklet, *Line Effects from Photographs by the Kodak Tone-Line Process*, just published by the Eastman Kodak Co. The conversions, which result in an effect similar to that of a pen-and-ink drawing, may be produced from any sharply detailed photographic film negative. No additional art work is necessary, except in cases where important characteristics or details must be clearly reproduced.

When used as a base for further art work, the process results in the production of pen-and-ink type pictures in much less time than would be required for hand drawings. It also makes possible photomechanical reproduction of illustrations without the use of a halftone screen. It is expected that the technique will prove of interest both to commercial and industrial users of line drawings who desire a fast, inexpensive means of producing line-drawing effects.

Copies of the booklet can be obtained without charge by writing to the Sales Service Division, Eastman Kodak Co., Rochester 4, N. Y.



Halftone reproduction (top) from which the tone-line reproduction (bottom) was made. Art work has been added to this line-drawing type illustration.



High-Speed Gear Units Require Close-Tolerance Machining

By John Morris, Staff Engineer
Western Gear Works, Lynwood, Calif.

GEAR units made at the Lynwood, Calif., plant of the Western Gear Works are employed to boost the speed of Diesel engines used in driving large centrifugal pumps. Such pumps, located along a 20-inch diameter pipe line, push oil from the derricks in the field to the refinery, 1000 or more miles away.

Since a typical 20-inch pipe line, operating under a pressure of 1000 pounds per square inch, often has a daily capacity of 250,000 barrels, every possible precaution is taken to avoid breakdowns. The gears in the speed-increasing units must transfer extremely heavy loads at high speeds. To permit such operation and minimize maintenance requirements, careful design of the units is essential, and close tolerances must be maintained in their manufacture. Generally, housings for the high-speed gear units are fabricated steel weldments. Designed for maximum rigidity to support the rotating elements and to retain the precise alignment of shafts and bearings built into it originally, the housing has rib members that prevent resonant vibration. The bearing units are attached to the housing, and precision-bored in place on the Giddings & Lewis horizontal boring, drilling, and milling machine shown in Fig. 1, to assure straight-

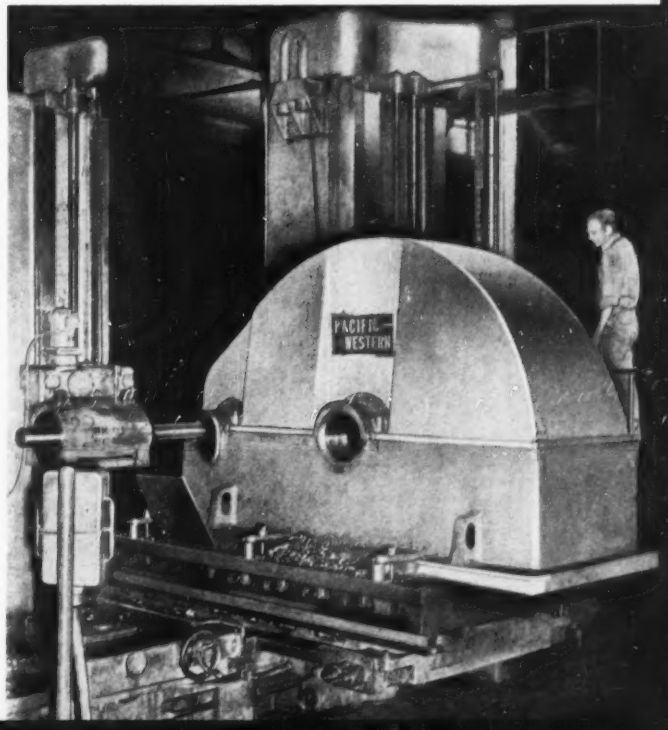


Fig. 1. Bearing units are attached to the gear units and precision-bored in place to insure alignment.

Fig. 2. Forged rim of bull gear is preheated and kept at temperature during welding by flames from gas lines.

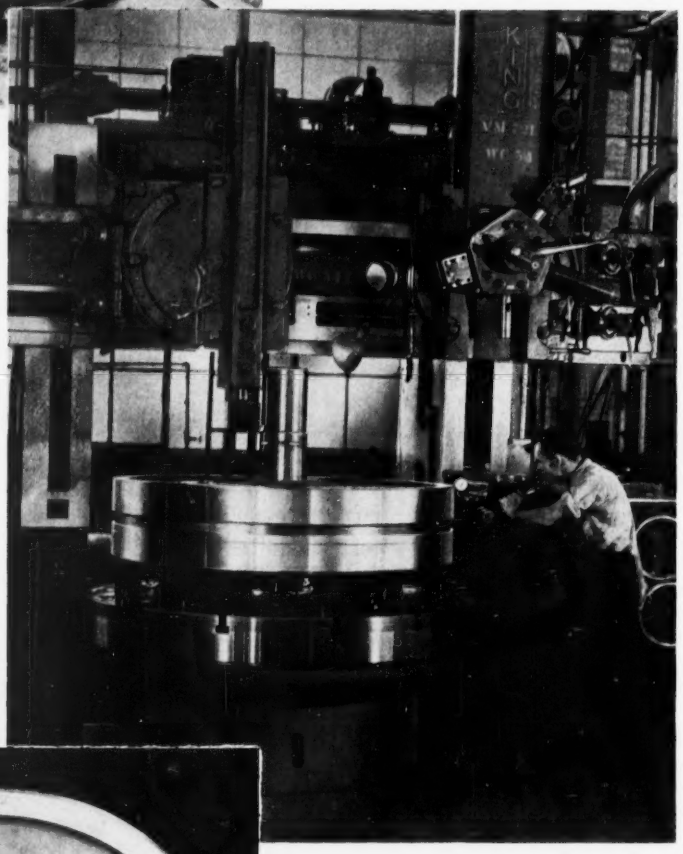


Fig. 3. (Right) Vertical boring and turning machine is employed to rough-turn periphery of gear blank and finish-turn the journals.

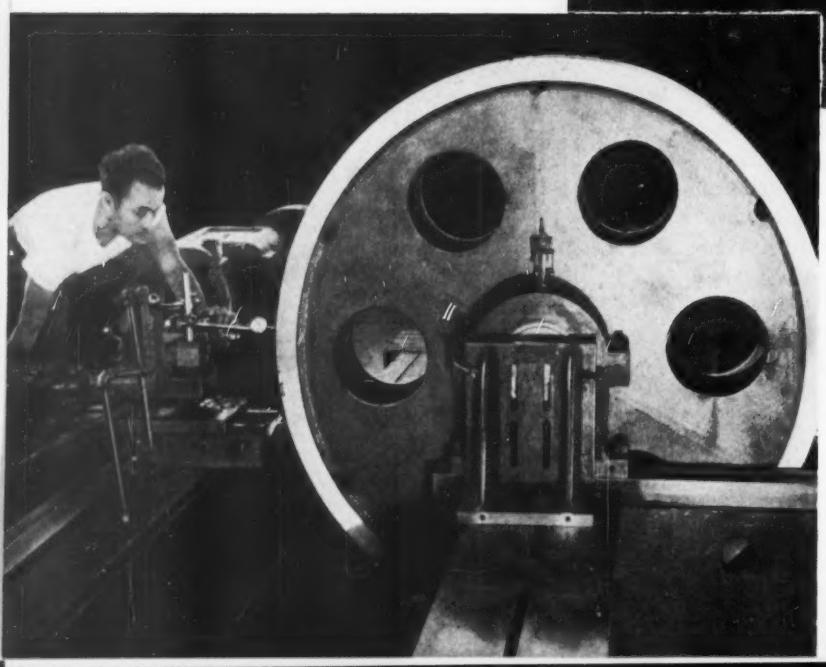


Fig. 4. Periphery and faces of gear blank are finish-turned on this special lathe, supporting the blank on journals.

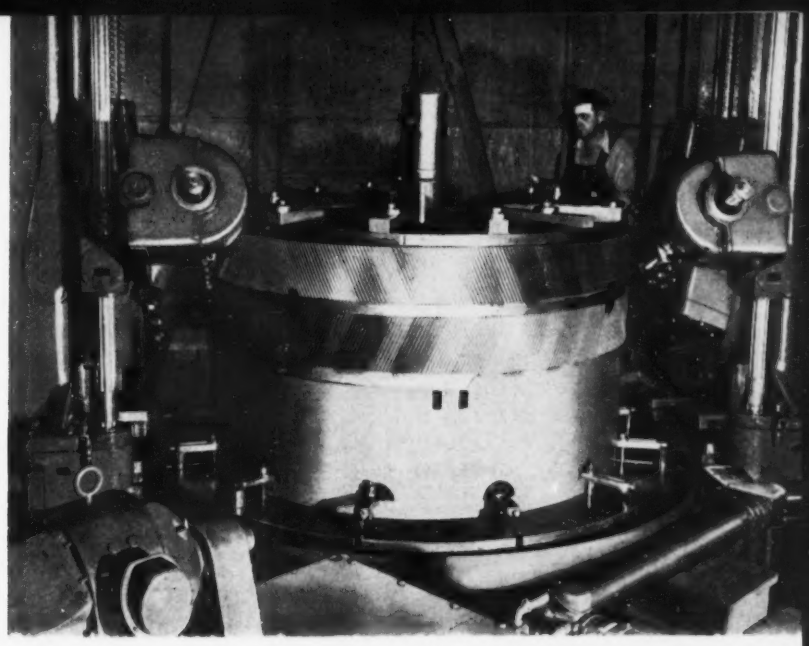


Fig. 5. Gear teeth are generated on this 120-inch hobbing machine, which is installed in an air-conditioned room.

through alignment. These bronze-backed, babbitt-lined elements are installed within split bearing housings bolted to the lower half of the gear-case, and are easily removable for inspection or service.

Gears are of double helical design. The bull gear is specially fabricated, using 3/4-inch thick steel webbing to connect the forged, S A E 4130 steel rim to the hub. How the rim is kept preheated by means of gas flames while it is welded to the webbing is shown in Fig. 2. The rim forging will have a finished dimension of 83 inches in diameter by 21 inches wide with a bore of 76 inches. Before rough-machining, the rim is annealed. Then it is heat-treated to a tensile strength of 100,000 pounds per square inch. The mating pinion is forged from S A E 4340 steel, and is heat-treated to a tensile strength of 130,000 pounds per square inch.

The bull gear weldment is first machined on a King vertical boring and turning machine, Fig. 3. Rough-turning of the periphery on the blank is done in the same set-up that puts the final finish on the journal surfaces. Surface finishes on the journals are particularly critical, and roundness is held to 0.0002 inch.

The gear blank is then set up in a special lathe, Fig. 4. Using the finish-turned journals as supporting surfaces, all finish-machining is completed with assurance that cuts will be made concentric with the journals. Run-out of the gear faces with relation to the journals is held to 0.0006 inch.

Gear teeth are generated on the blank by the continuous hobbing process, using a 120-inch Gould & Eberhardt hobbing machine, Fig. 5. This machine operates in a temperature-controlled room in which the temperature will not vary more than 3 degrees in twenty-four hours. Before any hobbing is done, however, the gear blank is set up and then quarantined for five days while the temperature within the room and that of the blank are stabilized to prevent introducing inaccuracies during cutting.

For this operation, specially selected, extremely accurate hobs and shaving cutters are employed. The spacing, pressure angles, involute

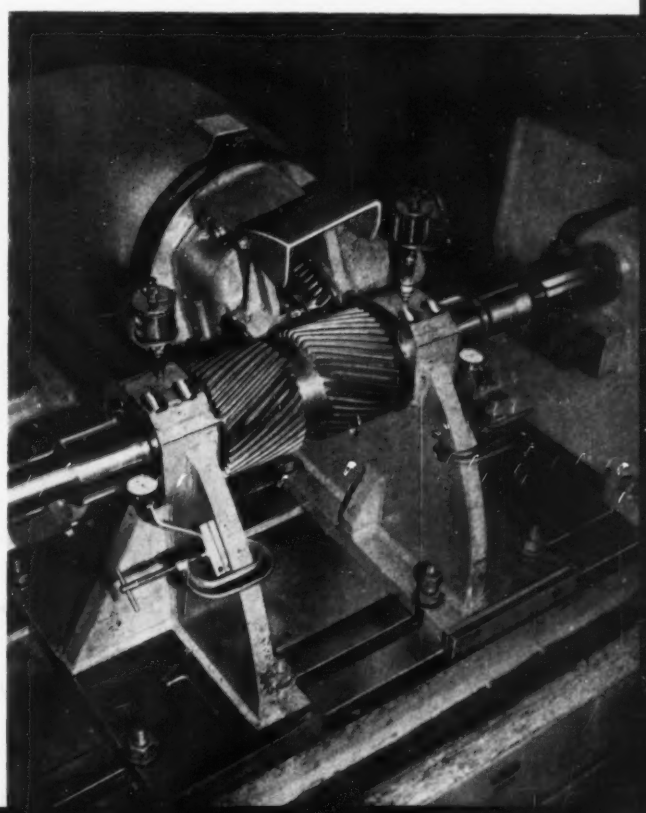


Fig. 6. Hobbed teeth on pinion for high-speed gear unit are shaved on this "Red Ring" gear-finishing machine. The pinion is then balanced.

profile, and other gear dimensions are carefully inspected to insure the high degree of accuracy required to avoid failure of the high-speed gears. Hobbing of such a large gear requires a full week, and, after cutting, the teeth are lapped with both high- and low-pressure laps to further improve tooth accuracies.

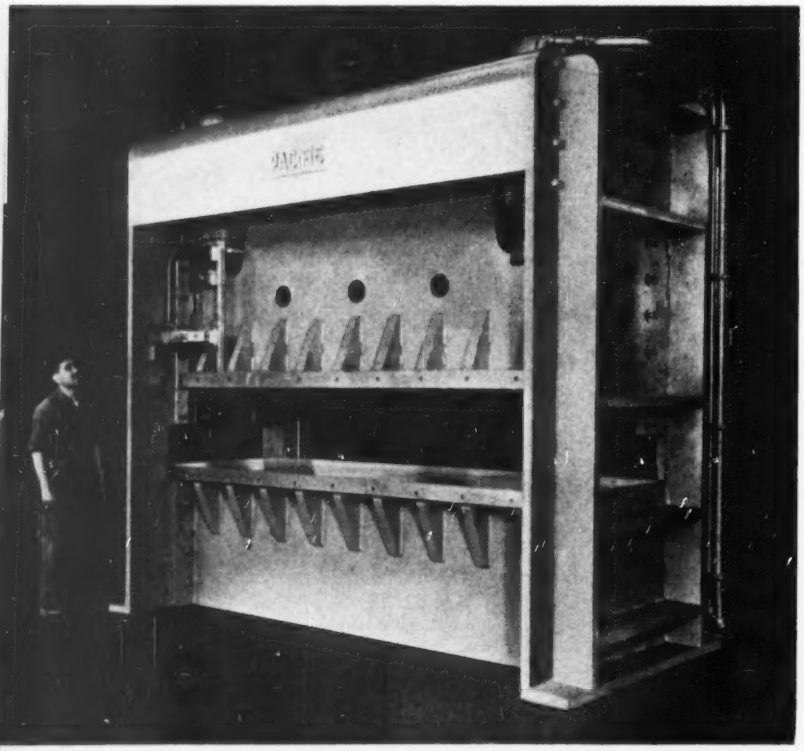
The pinion, meanwhile, is hobbed, and the teeth are shaved on the "Red Ring" gear-finishing machine, Fig. 6, made by the National Broach & Machine Co. Both the bull gear and the pinion are statically and dynamically balanced before they are ready for final tooth finishing. The gear and its pinion are set in journal housings that are spaced and aligned exactly as they will be in final assembly, and final polish lapping is done by actual operation of the bull gear against its own pinion.

After mounting on test stand bases, as seen in the heading illustration, and testing the lubrication system, the units are started and operated under varying load and speed conditions. This is part of the inspection that checks tooth contacts, bearing temperatures, operating conditions, cooling rates, and other features of the particular gear set.

Heavy Press Members Are Welded to Close Tolerances

PRESSES and press brakes built by the Pacific Industrial Mfg. Co., Oakland, Calif., are of arc-welded steel construction. They are made in capacities from 50 to 400 tons. The illustration shows a 250-ton straight-sided hydraulic press, typical of the company's line of specialized equipment.

The steel plate, slabs, and bracing angles are generally 3 inches in thickness and seldom less than 2 inches thick. Welding this material without preheating or postheating to avoid distortion requires careful selection of the process and rigid control of the procedure. Lincoln semi-automatic submerged-arc welding equipment is used in fabricating the presses and press brakes. On presses with a 14-foot blade or less, the platens are welded to the lower blade after machining. The platens are held within a straightness tolerance of 0.005 inch. Butt welds approximately 30 inches in length are produced without distortion.



A straightness tolerance of 0.005 inch is maintained in welding the platens of Pacific presses and press brakes

Drilling Unit Speeds Diode Assembly

BY utilizing the feed of a precision drilling unit for an assembly operation, a certain concern has been able to substantially increase its production of a tiny electrical component. The increased production, obtained at low cost and with few rejects, has been bringing the Radio Receptor Co., Inc., New York City, a booming business in germanium diodes. These diodes replace vacuum tubes in certain electrical circuits, and are commonly used in television receivers, electronic computers, and radar equipment.

The diode consists of two tiny nickel-silver cylinders, a piece of germanium, a tungsten cat whisker, and a plastic case. In making the diode, the germanium is first purified by heat-treatment. Then a minute wafer of the pure germanium is soldered on the end of one of the cylinders. A cat whisker is inserted in the other cylinder, extending from one end. Next, the cylinders are assembled into the case in such a way that the germanium and the tungsten wire make contact.

An arbor press is used for the initial positioning, or "rough squeeze," of the cylinders. In the "fine squeeze" that follows, the cat whisker is pressed against the germanium. This is a highly critical operation. Movement during the squeeze must be controlled within a tolerance of plus or minus 0.0002 inch, since the electrical characteristics of the end product are partially determined by the pressure of the tungsten cat whisker against the germanium. The device illustrated in Fig. 1 controls this pressure effectively.

Company engineers set up a Delta air-hydraulic drilling unit *A* in a horizontal position in line with a work-fixture *B*. Following the rough squeeze, the diode *C* is placed in the fixture, with one cylinder abutting a stop and the other resting over a bridge-piece *D*. During the feed of the quill *E*, a plunger *F* is thrust against the end of the cylinder on the bridge-piece. A special electrical circuit is closed by the predetermined contact pressure of the cat whisker against the germanium wafer. This circuit operates a micro switch that reverses the movement of the quill.

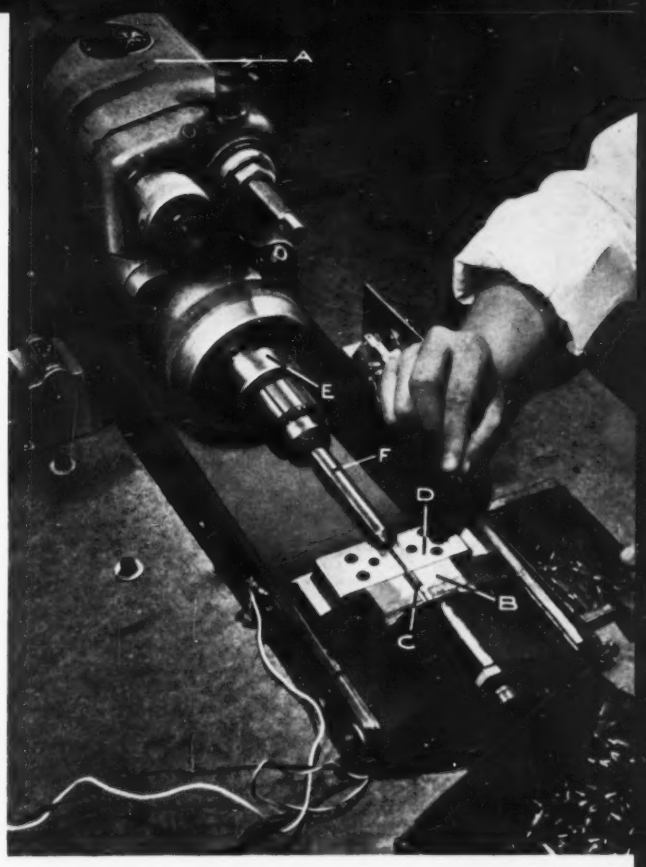


Fig. 1. This view shows the quill (E) in its retracted position, with the plunger (F) away from the diode (C).

In Fig. 2, the plunger is shown in contact with the cylinder. No mechanical stop is used. The amount of pressure of the cat whisker on the wafer depends on the time delay inherent in the electrical circuit, as well as the time required to overcome the inertia of the quill. Since the degree of inertia is directly related to the rate of feed of the quill, the pressure can be carefully controlled. Actually, the fine squeeze is produced after the circuit is closed, just before reversal.

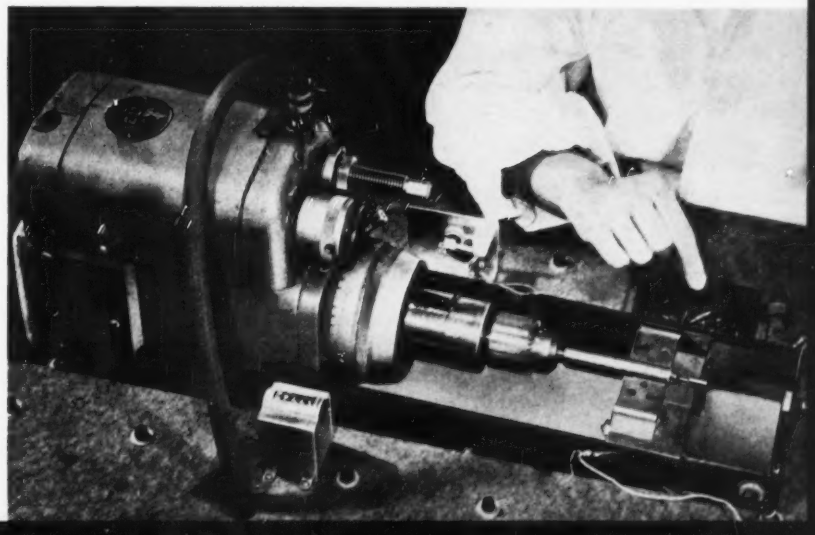


Fig. 2. The plunger is shown producing the fine squeeze during the time lag after quill-reversing circuit has been closed.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Very Thin Nickel-Silver Strip Now Available

With the lifting of restrictions on nickel, 18 per cent nickel-silver strip, precision rolled to very close tolerances and to thin gages and foils, has been made available by the Industrial Division of American Silver Co., Inc., 36-07 Prince St., Flushing 54, N. Y. This malleable and ductile metal is tough and highly resistant to corrosion, wear, and fatigue, and is used for both utilitarian and decorative purposes. It is custom rolled by this company in strip up to 6 inches wide and down to 0.0005 inch thick, to tolerances as close as plus and minus 0.0001 inch.

Typical uses for this nickel-silver strip include diaphragms, radio and telephone springs, component and contact material on commutators for low-current purposes—in the electrical and electronics industries; stamped, drawn, or spun articles; and automobile and marine trim.

Long-Life Corrosion-Resistant Coating for Protecting Steel

Protection of steel for periods of from five to ten years upon application of one coat of Adelphi One Coat Counter-Rust has been announced by the Adelphi Paint & Color Works, Inc., 86-00 Dumont Ave., Ozone Park 17, N. Y. This material, which is easily applied, isolates and neutralizes minor rust spots. Solvents have been practically eliminated in the formulation of this material to prevent the forming of pin-holes due to evaporation.

A Polyester Resin with Special Properties

A polyester resin that has special chemical and heat-resistant properties has been added to the basic line of polyester resins produced by the General Electric Co., Pittsfield, Mass. This resin, known as AR493, is expected to find wide acceptance among fabricators of exhaust ducting for chemical fumes; chemical storage and transportation tanks; washer tubs; and hundreds of other items subject to corrosion. Its higher heat resistance favors its widespread use in electrical applications, where increased importance is being placed on higher operating temperatures. Glass cloth laminates of this resin may have maximum continuous operating temperatures as high as 150 degrees C.; and intermittent temperatures up to 250 degrees C. are tolerable.

Low Melting-Point Cement Binds with Light Pressure

An industrial adhesive, so sensitive that it takes only fingertip pressure to join materials together, has been made available by the Cycleweld Products Division of Chrysler Corporation, Detroit 31, Mich. This liquid adhesive will permanently fasten rubber, metals, wood, plastics, ceramics, or fibers together in any combination. Extremely stable, it completely resists attack by salts, alkalis, acids, moisture, or solvents. The cement has already been adopted for use in building heavy machinery, radar, electronic equipment, and aluminum honeycombed panels for aircraft wings, fuselages, and stabilizers.

Vacuum Melted Alloys for High-Temperature Service

The commercial production of Ferrovac-52100 (a vacuum melted low-alloy steel), as well as high-purity nickel, copper, iron, and dilute alloys of these metals, has been announced by the Vacuum Metals Corporation, 70 Memorial Drive, Cambridge 42, Mass. Vacuum melting facilitates the precise control of very dilute alloying additions and impurity traces in producing these alloys.

Tests conducted on balls for bearings made from the vacuum melted low-alloy steel have indicated that the bearings would have a very long life. This material can also be considered for use in high-temperature applications, such vacuum melted alloys are used as electronic tube components.

Free-Machining, High-Carbon, High-Chromium Die Steel

"Olympic FM," a free-machining, high-carbon, high-chromium die steel of the D-2 cold-work die steel type, is now being produced by the Latrobe Steel Co., Latrobe, Pa. This steel may be machined at speeds and feeds in excess of those normally possible with standard D-2 steels. It has been demonstrated that the new material will produce machined surfaces that require a minimum of finish-grinding.

Abrasive-Filled Plastic Imparts Non-Skid Properties to Floors

An abrasive-filled plastic coating for floors which brushes on like paint in one simple application and dries to a thickness that is twenty times thicker than a conventional two-coat paint job is being marketed by Colonial Refining & Chemical Co., National Broadcasting Co. Bldg., Cleveland 14, Ohio. This coating, called Sure Grip, is now being employed to eliminate spills and falls that result in injuries and time losses. It dries within ten hours after application and resists the action of gasoline, oil, alcohol, and water. It is available in two colors—red or gray—and may be applied to wood, metal, or concrete surfaces.

Leaded Petroleum Compound Protects Metal Surfaces Against Corrosion

A leaded petroleum compound, developed for the protection of metal surfaces against corrosion, has been placed on the market by the Brooks Oil Co., 934 Ridge Ave., Pittsburgh 12, Pa. Barcote No. 600, as this material is called, is recommended for four basic types of applications: corrosion protection of structural steel and sheet metal; protection of rails and rail joints; lubrication of wire rope; and protection of metal parts while they are in storage.

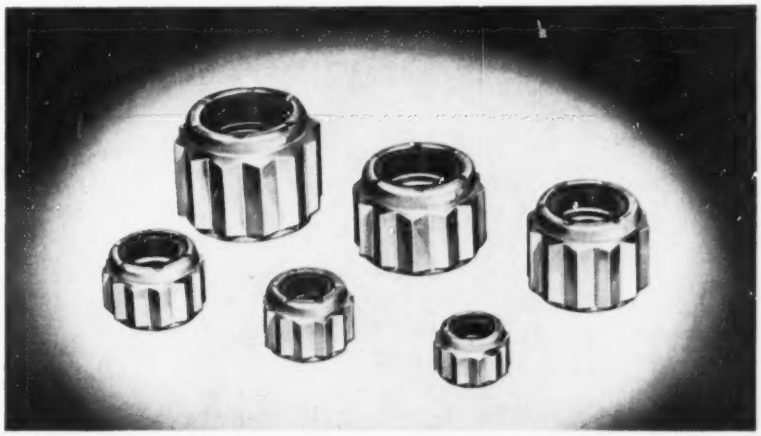
The compound may be applied by either the brush or the air spray method. When dry, it forms a thin, semi-hard, rubberlike film that can expand or contract without flaking, cracking, or pulling away. The compound will flow at 0 degrees F., does not emulsify with water, and has a penetrating action sufficient to carry it behind scale and through rust. It does not evaporate in storage, has a strong affinity for metals, resists the action of salt water, and is soluble in petroleum solvents.

Rosin-Flux Solder Composed of Three Components

The availability of Cen-Tri-Core energized rosin-filled solder, which is a rosin-coated solder wire covered with an outer solder sleeve, has been announced by Alpha Metals, Inc,. 56 Water St., Jersey City 4, N. J. This unique construction makes it possible to provide a solder wire with no flux voids and a means whereby flux can be made to flow ahead of the molten solder, thereby assuring less waste of material. Despite its high activity, the rosin is non-corrosive and electrically non-conductive.

Water-Repelling Leather Belt Preservative Exhibits Long Life

A leather belt preservative which gives long service and requires only infrequent application has been announced by the Viscol Co., 18 East Ave., Bridgeport, Conn. This preservative, called Clarol, contains no oil, grease, or resin, and will not turn rancid. Applied by brush, spray, or oil-can methods, it penetrates and acts as a lubricant for the fibers. It "sets" in the leather to form a gelatinous structure which does not creep to the surface. Clarol actually repels water and steam, rendering the belt water-proof without closing the pores to the air.



Titanium lock-nuts representative of those made by Elastic Stop Nut Corporation of America, Union, N. J., for use in the aircraft industry where weight saving is of great importance. Each nut weighs less than half of a similar steel nut yet meets the same tensile strength specifications. The titanium nuts now available are 12-point (double hexagon) nuts with nylon locking inserts in a diameter of size range of 5/16 to 5/8 inch.

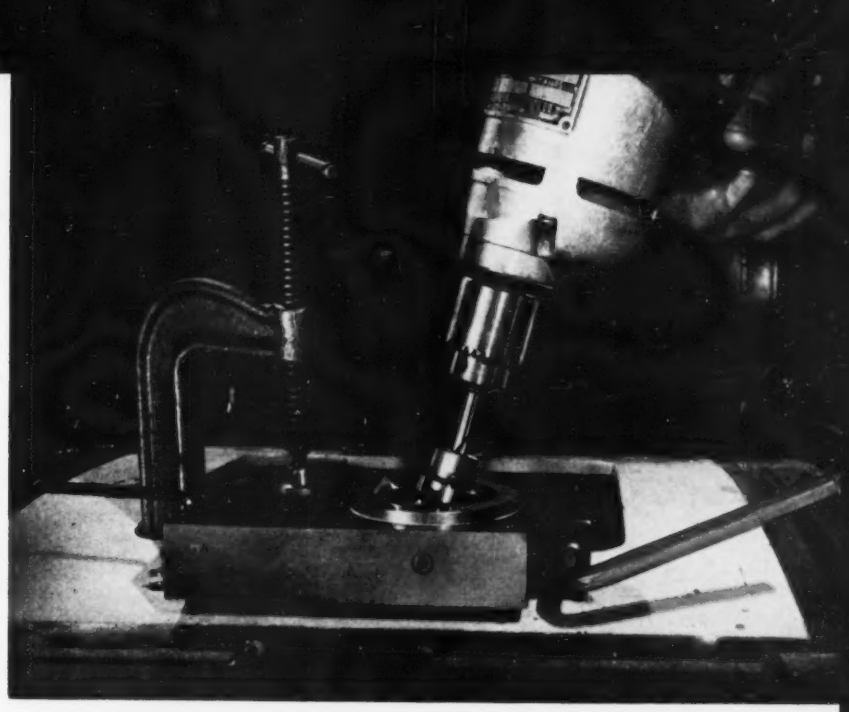
In Shops Around

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

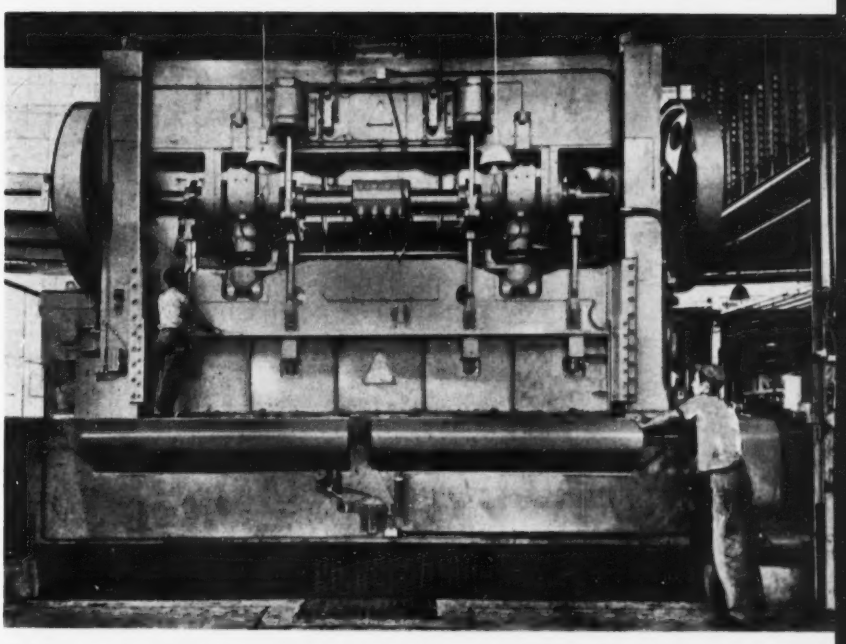
Brake-line cables for tractor trailers are automatically cut to correct length on this machine at the Warner Electric Brake & Clutch Co., Beloit, Wis. The cable is unreeled and advanced through feeder wheels for a distance pre-set on a length selector dial, then is severed.

Dies used at the Imperial Brass Mfg. Co., Chicago, Ill., are rapidly cleaned of forging scale in a Pangborn Hydro-Finish unit. A liquid blast polishes the work with a stream of suspended abrasive powder. Better die life and lower cleaning cost have been realized.

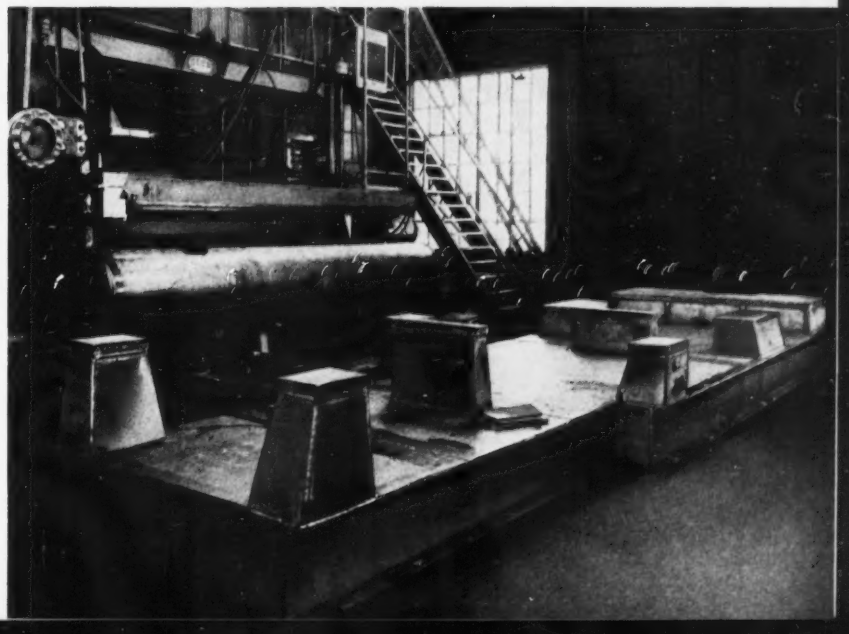
the Country



This universal ball-joint jig assures accurate angular drilling at the Temco Aircraft Corporation, Dallas, Tex. A ball segment containing the bushing sleeve is seated in a corresponding sphere in the jig block. Split construction of the block permits locking the segment at desired angle.



Producing expanded metal plate at the Penn Metal Co., Inc., Parkersburg, W. Va., on a newly installed press. The machine, one of the largest of its type ever built, simultaneously slits and expands heavy-gage steel plate to form grating.



This 9-ton weldment being fabricated at Bos-Hatten, Inc., Buffalo, N. Y., will serve as a base for two multiple-stage centrifugal compressors and a driving turbine. The entire structure will be portable, capable of being transferred by flatcar from one field location to another. In the background, a Lincoln automatic head performs a submerged arc weld along the seam of a manifold for a Diesel engine.

Rapid Machining of Plastic Parts

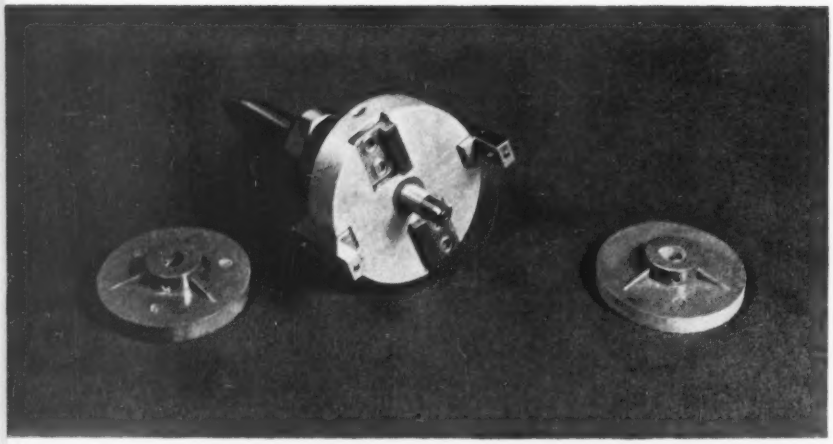


Fig. 1. Plastic cams as they appear before machining (left) and after (right). A special cutter (center), equipped with five carbide-tipped tools, turns the periphery, faces the flat side, and reams the central hole.

Facing, turning, and reaming of plastic cams are all performed in a fixture attached to a drill press using a special cutter having five carbide tools

By HERBERT CHASE

AMONG the many molded plastic parts used in machines built at the Endicott, N. Y., plant of International Business Machines Corporation are cams with hubs like those shown at the left and right in Fig. 1. Such plastic cams cannot be used as molded because of the close dimensional limits specified. Consequently, it is necessary to face one side, turn the periphery, and ream the cored hole in each part.

All of these cuts are made in a single application of the special cutter seen at the center in Fig. 1. The work-piece is held in a fixture applied to a drill press, illustrated in Fig. 2. Fastened to the cutter are five carbide-tipped tools. Two of the cutters, diametrically opposite each other, make turning cuts on the 3-inch diameter of the work-piece, removing from 0.005 to 0.020 inch of the phenolic plastic. Two more of the cutters

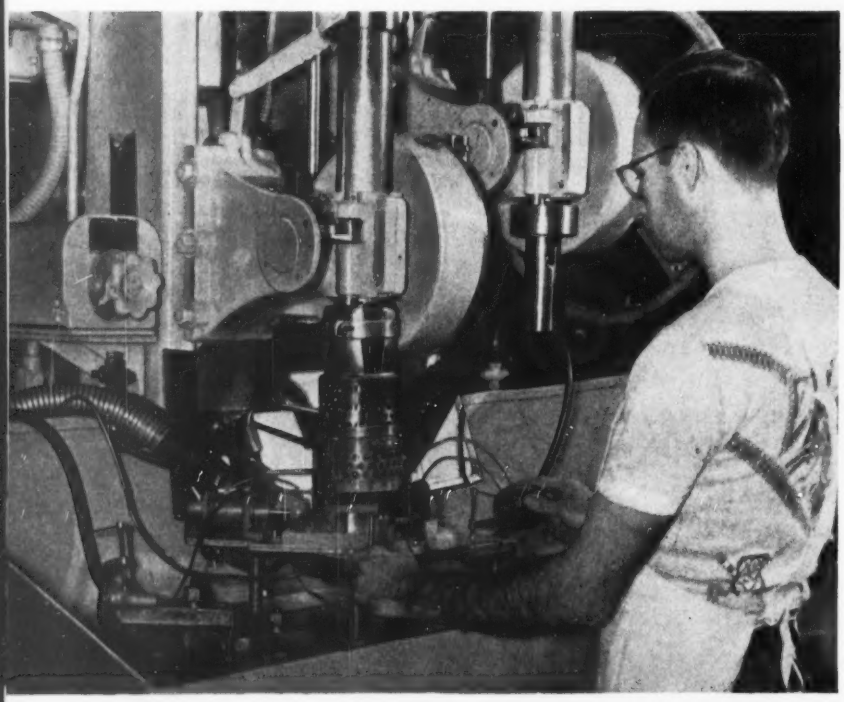


Fig. 2. Special fixture employed on a drill press equipped with the cutter shown in Fig. 1 to machine plastic cams at a rate of 200 to 250 per hour. A hand-lever swings the fixture outward for unloading and reloading.

perform the facing operation, in which about 5/64 inch of stock is removed, and the centrally located reamer cuts about 0.030 inch from the diameter of the cored hole.

The same cutter was formerly applied on another machine that produced only eighty-five pieces an hour, largely because of the time required for loading and unloading. To reduce this time and attain an output of 200 to 250 per hour, a special fixture was built and applied to the table of a drill press. The cutter is carried on a spindle that rotates at 1400 R.P.M. The fixture is designed to be swung out horizontally by hand, to facilitate loading and unloading, as well as to keep the operator's hands well away from the cutter. The cutter rotates inside a perforated steel shell for additional safety.

At the completion of the operation, the cutter retracts automatically and comes to rest. As it does so, the piece is automatically unlocked and the operator uses a lever to swing the fixture outward. He then removes the completed work-piece and replaces it with another molded plastic cam to be machined.

As the fixture is closed and locked by reversing the hand-lever, a valve is tripped and the plunger of an air cylinder locks the work-piece by closing a clamp around the hub. Simultaneously, the spindle of the drill press is started, feeds down to make the cut, and then retracts—all automatically—after which the fixture is opened and unloaded to complete the fast cycle.

Chips, together with any dust created by cutting, are drawn off through the suction hose of a portable vacuum unit connected as seen in Fig. 2. This not only keeps the fixture and surrounding areas clean, but prevents the dust from being a source of annoyance to the operator.

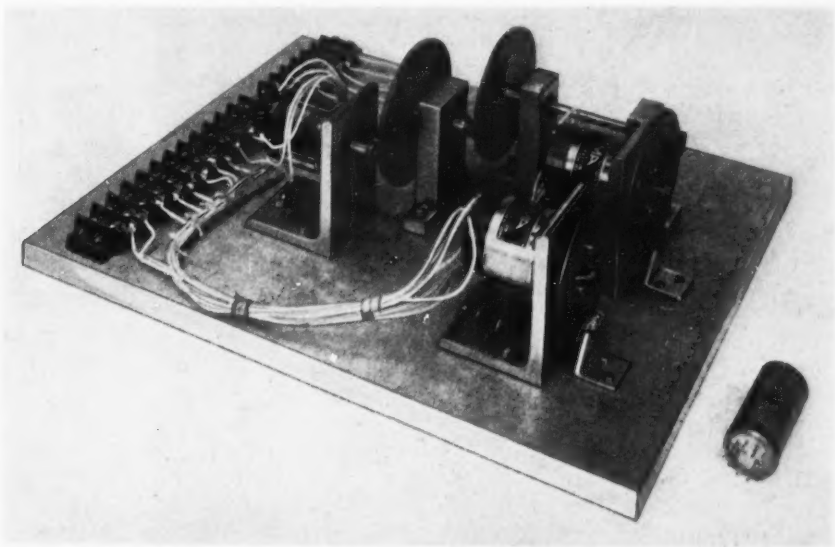
Although the fixture is not inexpensive, its cost is fully justified by the decrease in labor per piece, as the production rate is between two and three times that formerly attained. Also, the dimensional limits are readily held within the close tolerances specified.

* * *

Sub-Miniature Analog Computer Component

An analog computer component of sub-miniature size—approximately 3 cubic inches—has been developed at the research, development, and manufacturing center of the Arma Corporation at Roosevelt Field, Garden City, N. Y. It adds, subtracts, multiplies, divides, integrates, and performs basic operations of vector algebra and vector calculus, as well as other mathematical computations. The component makes use of a transducer in which an incoming electrical signal is dissipated into heat. Temperature differential thus created is communicated to a pair of heat-sensitive conductors mounted in a Wheatstone bridge. The output of the transducer is a direct function of the amount of unbalance caused in the Wheatstone bridge, and is also proportional to a reference signal supplied to the bridge for the purpose of detecting this unbalance.

There are no moving parts in this unit, all calculations being accomplished by the interchange of heat. Due to its compact size, light weight, and simplicity of operation and replacement, it is expected to find widespread application in the automation of airborne, as well as land- and sea-based, equipment. Adaptability to industrial and commercial uses is foreseen by Dr. Paul H. Savet, head of the company's Research Group.



The geared computer component assembly shown is replaced by the tiny heat-actuated component seen in the lower right-hand corner.

Brushing Lathe Deburrs Gears Automatically

PRECISION gears are now deburred by machine in one-half the time of a previous manual method at the Ford Instrument Co., Division of the Sperry Corporation, Long Island City, N. Y. In addition, scrap losses from faulty hand deburring have been entirely dispensed with—an important consideration because of the substantial machine time already invested in the gears in earlier operations.

The machine used is an Osborn brushing lathe, shown in Fig. 1. Actually, it has two distinct elements, a lathe unit *A* and a work-holding unit *B*. Brushes *C*, supported on the arbor of the lathe, rotate rapidly. The upper slide *D* of the work-holding unit has a powered rotary positioner *E*. On its front end is mounted a gear *F*, which is to be deburred. The positioner is universally adjustable in vertical and horizontal planes, so that the gear can be presented to the brushes at a compound angle necessary to

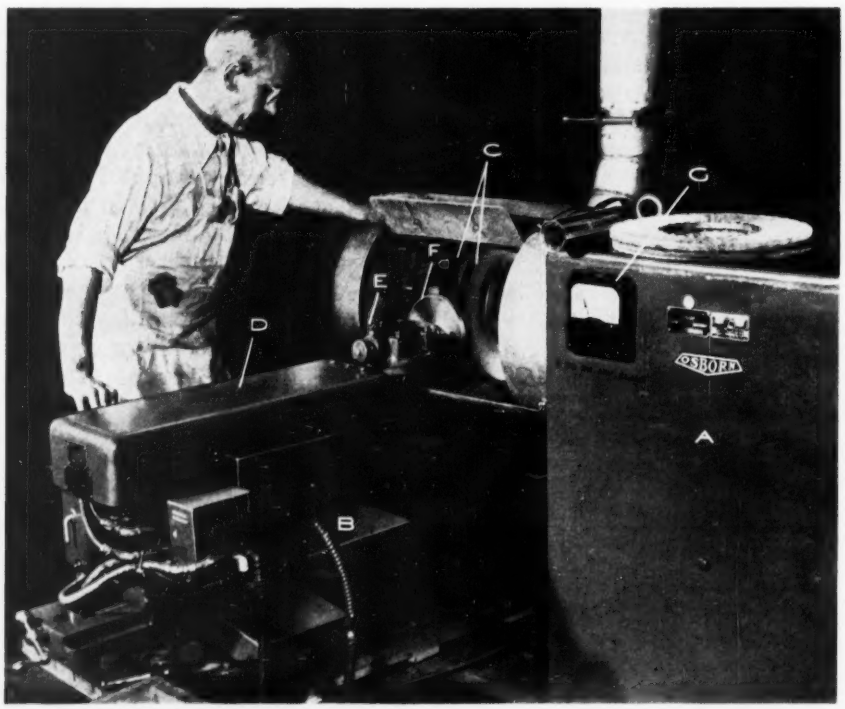


Fig. 1. During brushing, the gear is power-rotated by a motor drive built into the top slide.

Fig. 2. When retracted, the positioner is inoperative so that the gear can be loaded and unloaded.

obtain the desired brushing action. During deburring, the gear teeth intersect the path of the brushes, and the positioner rotates the gear slowly in relation to the speed of the brushes.

The cycling of the machine, which is entirely automatic once a gear is loaded, starts with the slide in a retracted position and the positioner not operating. By means of a push-button, the operator executes the deburring cycle: The positioner starts to rotate and the slide advances to a pre-set limit to present the gear teeth to the brushes; after remaining in working position until all the teeth are deburred, a pre-set timer then causes the slide to retract and the positioner to stop rotating.

The effectiveness of the operation depends largely on having the gear teeth exert the correct amount of pressure against the brushes. This pressure can be gaged by an ammeter *G* on the lathe. Each new size or type of gear is first deburred by trial and error. When the proper results are obtained, a record is made of the elevation of the column of the work-holding unit, the horizontal and vertical settings of the gear positioner, and the ammeter reading of brushing pressure. With this information tabulated, all set-ups can be duplicated with a minimum of effort and time.

In Fig. 2 is seen the arrangement of two Tampico brushes which straddle the gear face. Metal particles are directed into an exhaust flue attached to a hood that encloses the brush arbor.

Machine Tools Can Now Be Leased

METAL-WORKING plants can now modernize their milling departments without a major investment in machine tools. Under a newly instituted Tool-Lease program, the Kearney & Trecker Corporation, Milwaukee, Wis., is offering for rental all standard units of its manufacture—plain, universal, vertical, and rotary-head knee type milling machines; simplex and duplex bed type milling machines; and precision boring machines, as well. Equipment leasing, in effect in other industries for many years, is a relatively new and different approach in the machine tool field. The program is designed to supplement, not replace, Kearney & Trecker's arrangement of selling machine tools outright or on an installment basis.

Tool-Lease, it is claimed, has certain inherent advantages for the equipment user. Working capital can be released for other purposes and production expanded without further debt, so that future borrowing capacity is not being limited. The leasing company is assured of the services of a machine as long as it is needed, without being committed to the total life of the machine, thus avoiding the risk of high obsolescence. This, in turn, permits the company to operate at peak efficiency. Furthermore, the lessee can test the performance and suitability of a machine on his own job before buying it.

Three optional leasing plans are being offered, all having a term of seven years. The accompanying table gives the terms under each plan. Under Plan A, for example, the customer pays a rental of 25 per cent of the purchase price of the machine tool for each of the first three years, then 10 per cent for each of the remaining four years. At any time after the third year, he may elect either to return the machine or buy it. Should he buy it after the third year, it costs him 45 per cent of its original price, as indicated in the table. After the fourth year, it costs only 40 per cent, and so on. Initial rentals under Plans B and C are higher, but give the lessee the opportunity to return or buy the equipment at earlier dates. It will be noted that the total rental for a seven-year period costs the same in all three plans. Kearney & Trecker retains title to the equipment during the length of the lease, and at its expiration may re-lease, rebuild, or dispose of the equipment at its discretion.

Kearney & Trecker Tool-Lease Plans

Rental Year	Plan A		Plan B		Plan C	
	Rental Per Cent of Original Price	Purchase Per Cent of Original Price	Rental Per Cent of Original Price	Purchase Per Cent of Original Price	Rental Per Cent of Original Price	Purchase Per Cent of Original Price
1	25		30		35	80 *
2	25		25	60 *	25	60
3	25	45 *	20	45	15	45
4	10	40	10	40	10	40
5	10	35	10	35	10	35
6	10	30	10	30	10	30
7	10	25	10	25	10	25

* The customer may purchase or return the equipment at the end of this year, or any year thereafter.

INGENIOUS *Mechanisms*

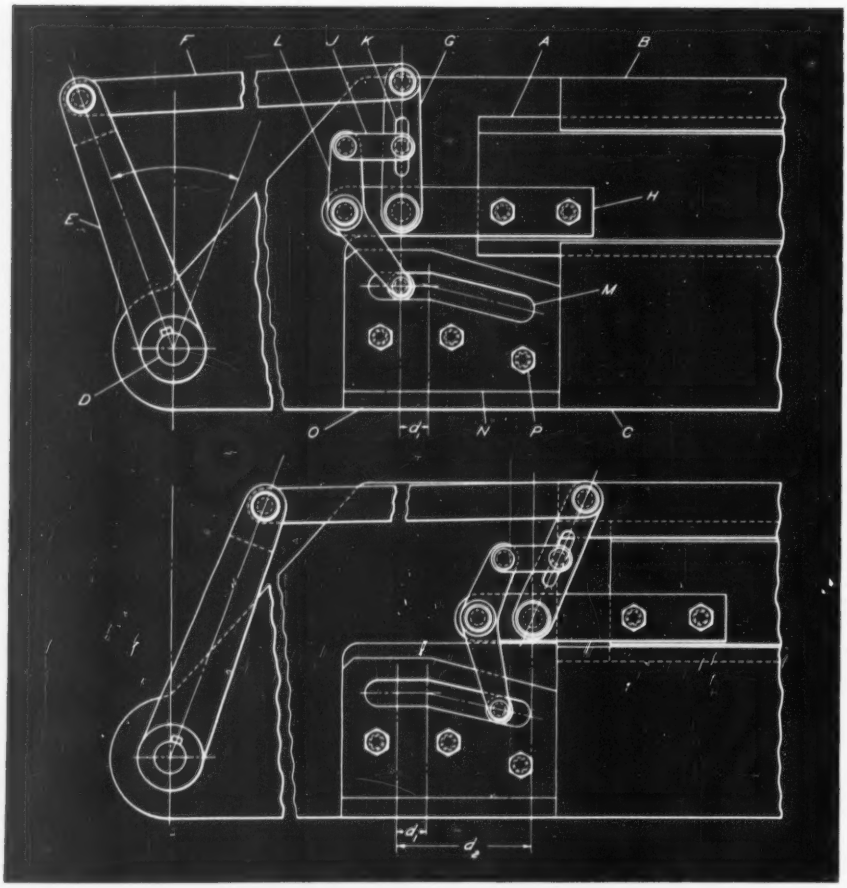
Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Oscillating Drive-Shaft Actuates Slide at Variable Speed and Stroke

By W. M. HALLIDAY, Southport, England

A slide to move light packages across a wrapping table had to be driven by an oscillating shaft and lever. The position, length, and amplitude of the lever arm were fixed, since the lever also actuated another mechanism synchronized with the motion of the slide. It was not possible to attach the lever directly to the slide because of certain peculiarities of the slide motion.

First, the slide stroke had to have a range of adjustment, from a 9-inch minimum to a 10 1/2-inch maximum (direct attachment of the lever and slide would have produced a 13-inch fixed stroke). Second, in its forward movement the slide initially had to travel in unison with the lever for a distance of 2 inches, then gradually decelerate; and in its return movement, the slide initially had to accelerate gradually to a point 2 inches from the end of the stroke, then travel in unison with the lever. Third, provision had to be made to vary within small limits the distance of slide travel in unison with the lever. In this respect it was required that the distance of slide travel in unison with the lever vary from 2 inches at the maximum slide stroke to 3 1/4 inches at the minimum stroke.



Converting the oscillation of drive-shaft (D) to a reciprocation of slide (A) through this mechanism permits the stroke to be of adjustable length and made at varying velocity

The mechanism that was devised is here illustrated. The upper and lower views show, respectively, the position of the elements at the beginning and end of the forward stroke. Slide *A* is dovetailed to and reciprocates along guideway *B* formed in the vertical side of frame *C*. Oscillating drive-shaft *D* and lever *E* are supported on the same frame, but at a considerable distance from the slide.

The top of lever *E* has a slot through which is pinned the long rod *F*. At one end, rod *F* is joined to arm *G* which, in turn, pivots on bar *H* fastened to slide *A*. Link *J* pivots around an adjustable point in slot *K* of arm *G*, and the left-hand end of the link is pinned to the upper limb of bellcrank *L*. The bellcrank swings on bar *H*, and its lower limb carries a roller fitting slot *M* in plate *N*. It will be noted that one section of the slot is shorter and parallel to guideway *B*, and the other section is longer and at a decline. The extent of these two sections, as well as the angle of the decline, is carefully determined in accordance with the desired total length of slide travel and range of speed variation.

Plate *N* is secured in channel *O* of the frame by set-screws *P*. The studs holding arm *G* and bellcrank *L* to bar *H* are the same center distance apart as the studs in link *J*, so that the upper limb of the bellcrank and arm *G* are parallel at the beginning of the slide stroke.

On the forward stroke, lever *E* swings clockwise and slide *A* moves to the right. Arm *G* and bellcrank *L* move as a unit with the lever and slide. They have no swivel of their own relative to bar *H* as long as the roller on the lower limb of the bellcrank traverses the horizontal section of slot *M*, identified as distance d_1.

However, as the roller reaches the inclined section of the slot, the bellcrank and arm *G* start to swivel clockwise, slightly at first, then in increasing degree. Since the travel of arm *G* is restricted by its connection to rod *F*, the effect of its swivel is to gradually shorten the stroke of slide *A* and also to diminish its velocity. Thus, at the end of the forward stroke, as seen in the lower view, the slide will have traveled a shorter distance, identified as d_2, than rod *F* has traveled.

On the return stroke, the slide starts slowly, gradually accelerating as the roller travels up the incline, after which the velocity of the slide is the same as rod *F*. The mechanism illustrated produces a slide stroke of approximately 9 1/2 inches.

If link *J* is adjusted to a lower point in slot *K*, bellcrank *L* is caused to swivel clockwise independently of arm *G*. The roller on the lower limb of the bellcrank will then shift farther to the left in slot *M*, giving a longer travel over the horizontal section of the slot and a shorter travel over the decline, producing a combination of a shorter slide stroke having a longer distance of travel in unison with lever *E*. Conversely, if link *J* is adjusted higher in slot *K*, a longer slide stroke with a shorter distance of travel in unison with lever *E* is produced.

Greater variation in stroke movement and speeds may be obtained by adjusting plate *N* on frame *C*. For this purpose, set-screws *P* pass through elongated slots in the plate.

Ratchet-Tripping Mechanism Controls Cut-Off Length of Sheets

By Haim Murro, Bayonne, N. J.

A mechanism employing a feed-ratchet tripped indirectly by a roller chain for pre-setting cut-off lengths was designed for an expanded-metal fabricating machine. The ram type machine has toothed blades attached to a slide that reciprocates crosswise on the sheet between strokes. The blades punch and expand openings in a solid steel sheet.

During the first stroke, the slide is laterally situated in one extreme position. Then, after the material has been fed forward a distance equal to one row of perforations, the blade slide moves into the opposite extreme position for a second stroke. Thus the rows of expanded openings are staggered on the sheet. The expanded metal is cut off from the solid sheet each time that the feed mechanism is prevented from functioning by the ratchet-tripping device here described.

The adjustable ratchet arrangement employed for feeding the metal sheets is shown in Fig. 1. Ratchet wheel *A* is intermittently rotated by feed-pawl *B*. The feed rate may be controlled by the adjustment of knob *C* to change the radial location of the driver that imparts motion to the feed pawl.

Slide *D*, which is retained between two guides *E*, trips the feed-pawl *B* directly. The slide is shown in its extreme right-hand position at X, held there by spring *F*. The left-hand end of the slide is an arc of approximately the same radius as ratchet wheel *A*. Roller *G*, attached to the feed-pawl, rides on this rounded end when the slide is forced to the left.

Slide *D* is actuated by the ratchet-driven roller chain mechanism at the right in view X. A non-adjustable eccentric *H*, mounted on the drive-shaft, actuates pawl *J*. In turn, pawl *J* imparts intermittent motion to the ratchet wheel *K*. The eccentricity of member *H* was calculated to advance the ratchet wheel one tooth for each revolution of the drive-shaft.

A chain sprocket L is mounted on the same shaft as the ratchet wheel. This sprocket carries a roller chain M which is held in tension by idler sprocket N. Ratchet wheel K and sprocket L have the same number of teeth so that each feed movement of the pawl will advance the chain a distance of one link. Cam O, bolted to one of the chain links, operates slide D against roller G once for each complete cycle of chain movement.

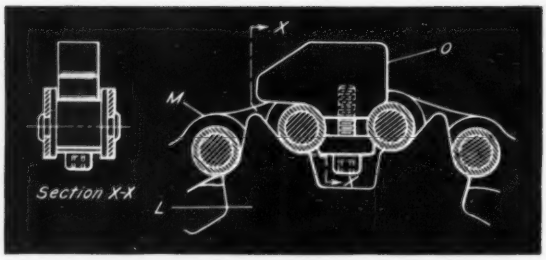
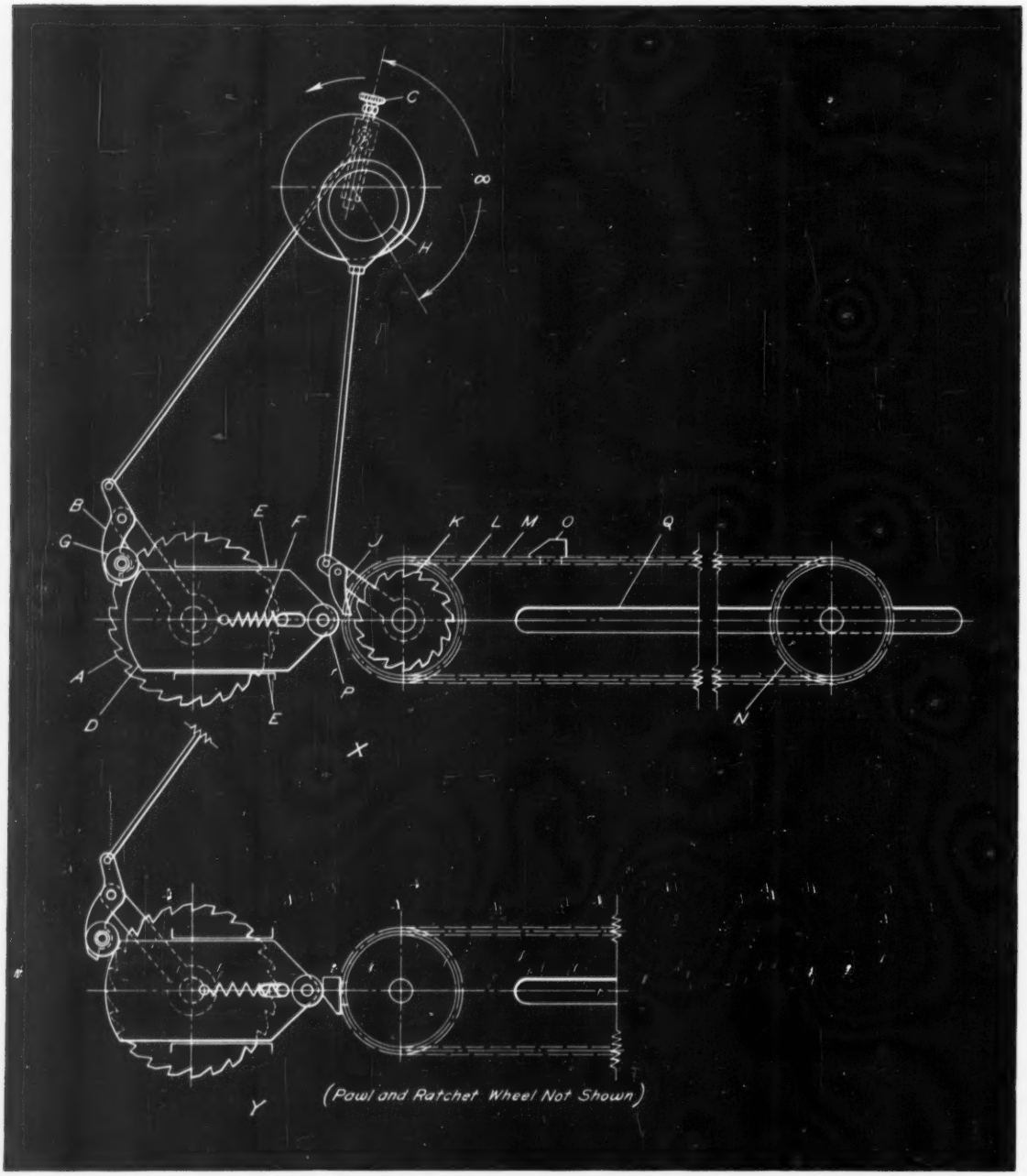


Fig. 2. (Above) Detail drawing showing how cam that actuates tripping mechanism is screwed between two rollers of the standard sprocket chain

Fig. 1. (Below) Ratchet-tripping mechanism for interrupting a press feed at pre-set points, shown in feeding position at X, and non-feeding position at Y



The arrangement of the mechanism during the feeding phase of the cycle is shown in view X. The slide is positioned at the right, allowing feed-pawl *B* to function normally. As the operation continues, the roller chain moves counterclockwise until the tapered front surface of cam *O* engages roller *P*. This forces slide *D* to the left, against spring pressure, to contact roller *G* and disengage the feed-pawl *B* from ratchet wheel *A*. The mechanism is then in the non-feeding phase of its cycle, as seen at Y. The next revolution of the drive-shaft will index the sprocket *K* through a distance of one tooth and move cam *O* past roller *P*. Spring *F* then returns slide *D* to the right-hand position so that feeding of the work will continue.

During the non-feeding portion of the cycle, the fabricated metal is cut off from the solid sheet. For various cut-off lengths, chains of different lengths are used. A slot *Q* is provided for the purpose of adjusting the idler sprocket either backward or forward to accommodate the various lengths of chain required for different jobs.

Angle α should be selected to make the two pawls operate in opposite directions. This will assure that either a feeding movement will occur or that there will be absolutely no movement; therefore a condition will never arise in which a feed movement is partially made before feed-pawl *B* is disengaged.

The manner in which cam *O* is mounted to the chain is illustrated in Fig. 2. The cam fits into one of the links and is clamped on two chain rollers by a machine screw and washer. To accommodate the head of the screw, every second tooth of the sprocket is milled away to form a slot. It is therefore essential that a sprocket with an even number of teeth be employed.

Spiral Saw Bands Lower Die Costs

When contour sawing intricate internal outlines, problems are often encountered in following the lay-out lines, even when the narrowest band-saw blades are used. Such problems can frequently be eliminated by using spiral edge saw bands. On these bands, the hard cutting edge spirals around the band so that it can cut in any direction without rotating the work.

Many of the tooling requirements at the Reynolds Metals Co., Grand Rapids, Mich., involve extrusion dies of most complex forms, and their use of spiral saws is slashing previous filing costs tremendously. Variations in the dimensions of these dies are from 6 to 20 inches in diameter, 1/2 inch to 7 inches in thickness, and 0.020 to 0.100 inch in form width. Most applications, however, are within the range of the three available diameters of spiral saws, 0.040, 0.050, and 0.074 inch.

For example, both extrusion dies shown on the DoAll band machine table in the illustration, although requiring slightly varying form widths, are ideal applications for the 0.074-inch diameter spiral saw. Rather than having to take a double cut with a narrow width band, the spiral saw cuts clean, true, and precise to within a few thousandths of an inch of the outline. In fact, sawing and filing time on the die shown standing upright has been reduced from thirty-eight to eighteen hours. Time saved on the other die amounts to approximately six hours. Although sections up to 1 1/2 inches thick have been taken out of the solid with spiral saws, the time element shows that 1 inch thickness should be the maximum. On the thicker sections, the die should be relieved on its under side.

Use of spiral saw bands saved twenty hours in the manufacture of extrusion die illustrated at the left, and saved six hours on die at right.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Die with Cams that Operate Punches in Opposite Directions

By FEDERICO STRASSER, Santiago, Chile

If a hole is punched in a part before bending and is located close to the bending zone, it will be distorted during the operation. For this reason, it is frequently preferable to pierce holes in stampings after they have been formed.

The U-shaped stamping shown at X, Fig. 1, presented an interesting tooling problem. The blank is cut from 0.4-inch wide cold-rolled steel strip stock by means of a cut-off die that incorporates punches for the two holes in the bottom of the part. The problem was to produce the two elongated holes. Drilling was impractical, and the proximity of the holes to the bends made it necessary to punch them after forming. A conventional die, punching from the outside, would not serve the purpose since the hole would be located too near the edge of the required internal die-plate. Therefore it was desirable to design a punch and die that would pierce from the inside of the legs.

The solution was found by designing a novel die that would function within the comparatively small space available between the legs of the stamping. The part is located in a nest formed by grooves in two stripper plates *A*, Fig. 1, and locked in place by a quick-acting toggle clamp *B*. As the press is actuated, cam-holders *C*, Fig. 2, which are attached to the ram, descend and the punching cams *D* contact matching surfaces of the two punch-holders *E*, as seen at the right-hand side of Fig. 3. The punch-holders, together with the punches *F*, are forced outward to punch the holes in work-piece *G*. It will be seen that contact surfaces of the cams and punch-holders are machined at an angle.

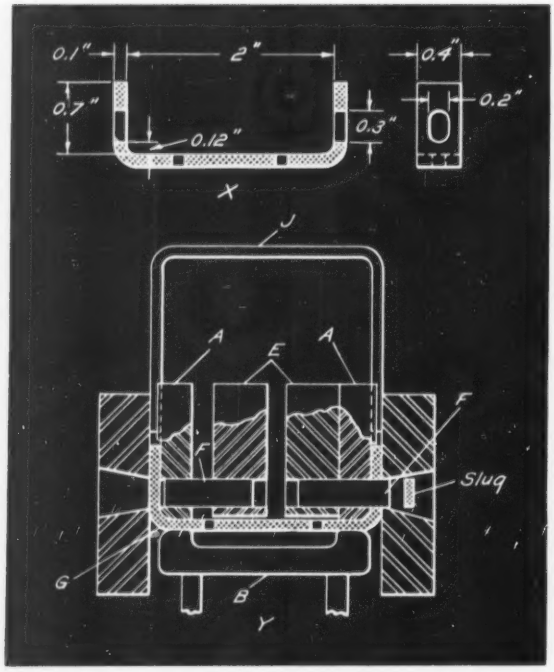


Fig. 1. Plan view showing left-hand side of die prior to punching, and right-hand side in the act of punching. The cams are not shown.

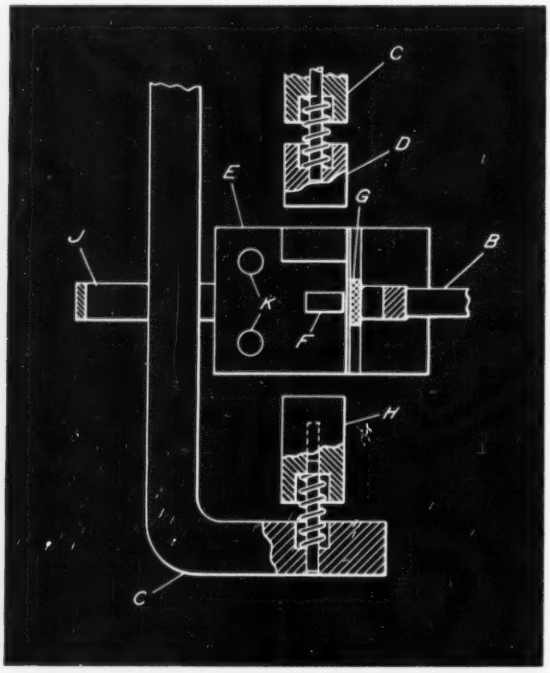
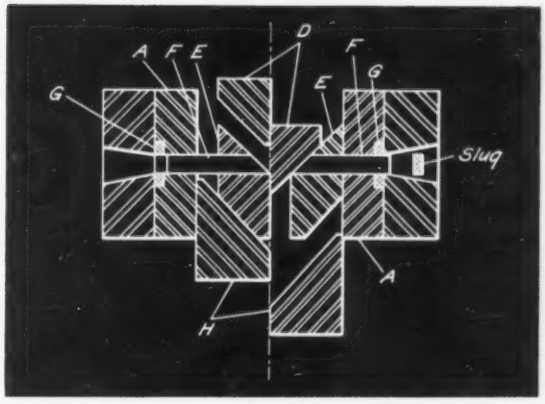


Fig. 2. Diagram illustrating how compression springs are situated between punch-holders (C) and cams (D) and (H) for safety.

Fig. 3. Sectional view showing punching cam in operation at right and stripping cam in operation at left



Two stripper cams *H* wedge between the punch-holders and the stripper plates on the return stroke, forcing the punches inward to their original position as seen at the left-hand side of Fig. 3. It was necessary to provide a positive-acting stripping device, as the limited space prohibited automatic stripping by means of compression springs. At the end of the return stroke, the completed parts are ejected by means of a manually actuated device *J* that pushes against the ends of the legs.

The cams are mounted free in their holders so as to avoid the necessity of fine adjustment of the press-ram stroke. A compression spring provides a small amount of overtravel of the cam-holder after each phase of the cycle. Alignment of the punches is maintained through a sliding fit of the punch in the guide hole and by two alignment pins *K*, shown in Fig. 2, located between the punch-holders and stripper plates.

Gage for Checking Sizes and Location of Tapers on Shafts

By WILLIAM MORSON, Birkdale, England

Many shafts and rods have one end tapered to permit mounting a gear lever or cam. In machining tapered shafts of this kind, it is often necessary to accurately check the size and degree of taper, as well as the location of the tapered portion relative to a shoulder or one end of the shaft. A simple, accurate gage and accessories developed to facilitate rapid checking of such tapered parts are shown in Figs. 1 and 2.

The casehardened mild-steel body *A* of the gage, seen in Fig. 1, is bored horizontally to provide a parallel bearing hole into which is lightly press-fitted the cylindrical shank of the headed, hardened steel bushing *B*. This bushing has a tapered hole ground to the angle of taper and dimensions required on the finished shaft to be gaged. The bushing is secured in block *A* with its head held in contact with the end face of the block by means of a headless screw *C*. Interchangeable bushings *B* with tapered holes of different sizes should be provided.

Below and in parallel alignment with the bushing hole in block *A* is a deep slot fitted with a hardened and ground rectangular steel bar *D*. This bar is a light press-in fit within the slot and is accurately aligned in both planes with the axis of the taper hole in bushing *B*. Bar *D* is retained in block *A* by a flat steel plate fastened to the under side of the block by four screws. There should be no looseness or sidewise movement of the bar in the block. A knurled head locking screw *E* in a tapped hole in the front wall of the block *A* permits clamping the bar *D* in desired endwise settings.

The over-all length of bar *D* is made to suit the maximum and minimum lengths of shaft components to be gaged by the measuring pin shown at *F* mounted in the right-hand end of the bar. The bar is made adjustable in block *A* to accommodate work or shaft *W* of different lengths. The right-hand end of bar *D* is cross-drilled to receive the hardened steel cylindrical measuring pin *F*, which must be positioned exactly at right angles to the longitudinal axis of the tapered hole in bushing *B*. The pin *F* is ground to a close sliding fit in the bar; and is prevented from rotating within the bar but permitted a limited amount of crosswise sliding movement by means of an elongated slot machined in one side wall of the bar. A small peg *G* in pin *F* is a sliding fit in the slot. The slot is long enough to permit the pin to be retracted transversely a sufficient distance to allow shaft *W* to be inserted in the bushing *B*.

The two shallow flats *H* and *I* in accurate axial alignment with each other on pin *F* are of different depths. The difference in their respective depths is made equal to the maximum tolerance permissible on the lengthwise location of the conical portion of the shaft with respect to its opposite end. The flats are accurately located at right angles to the axis of the tapered hole in the bushing *B*.

Bar *D* can be set in different endwise positions in block *A* to suit various shaft lengths by means of the hardened and ground locating pin *J*, which is a close sliding fit in a hole in body *A*. A series of locating holes *K* spaced to suit the lengths of shafts that are to be inspected is machined into the side of bar *D*. If the gaging device is to be

in constant use for checking large numbers of shafts in batches of different lengths, it is advisable to make the engaging end of pin *J* conical in shape and to have holes *K* similarly machined to match the pin. This simple provision will help compensate for the effects of wear on both the pin and the locating holes.

The five holes *K* in bar *D*, indicated in the upper view in Fig. 1, permit five different shaft lengths to be gaged. The retaining plate at the bottom of body *A* is extended at the front and rear sides, as shown in the upper view. These extended sides are drilled to take suitable hold-down screws for fastening the gage to a bench or stand.

The size of the taper on the shaft or work *W*, and its location relative to the opposite end of the shaft, can be gaged at a single setting of the component in the gage. To check the accuracy of the angle and dimensions of the conical portion on the left-hand end of the shaft, the sliding measuring pin *F* is first retracted so that the shaft can be inserted in the bushing *B*. The surface of the tapered bore in bushing *B* is coated evenly with a marking pigment, such as Prussian blue. By holding the shaft in contact with the coated hole and turning it gently for slightly less than 180 degrees, patches of Prussian blue will be rubbed on the conical end of the shaft. This gives an excellent indication of the correctness of the angle of taper.

Having determined the accuracy of the tapered portion of the shaft, its location can be gaged by means of the sliding measuring pin *F*. Still holding the shaft in close contact with the bore of bushing *B*, the pin *F* is advanced. If the conical portion is located correctly, the first flat *H* on the pin should pass smoothly over the right-hand end of the shaft but the second flat *I* should not pass. To guide the operator when adjusting the gaging pin, the top side of that member should be stamped with the words GO and NOT GO opposite flats *H* and *I*, as illustrated. This stepped sliding pin makes it easy to gage shafts within limits of plus or minus 0.003 inch.

If shafts *W* should be very long—necessitating the use of an equally long bar *D* and so causing the measuring pin *F* to be situated a considerable distance from the bushing *B*—it will be advisable to employ a rest such as shown at *L*, Fig. 2. The work is thus supported at the end near the measuring pin *F* to avoid errors due to the sagging of that end of the shaft. The cylindrical shank of rest *L* is closely fitted in a hole drilled through

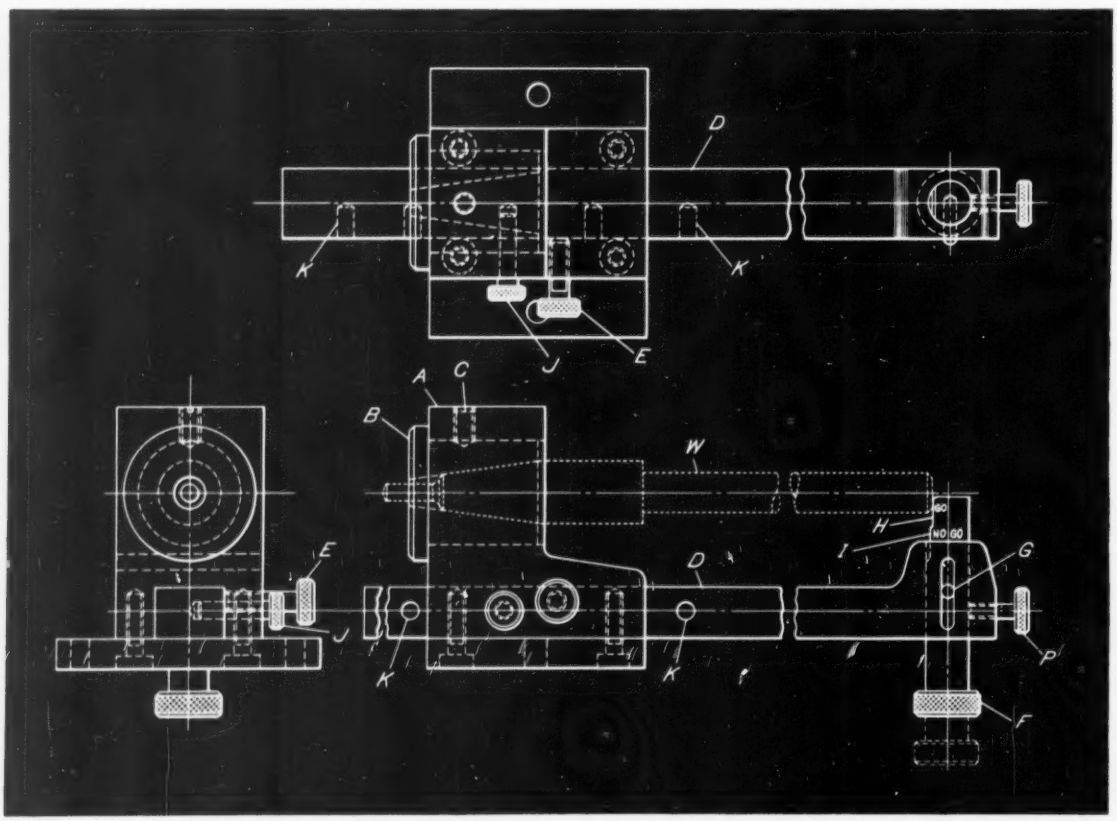


Fig. 1. Gage designed for checking sizes and location of tapers on shafts

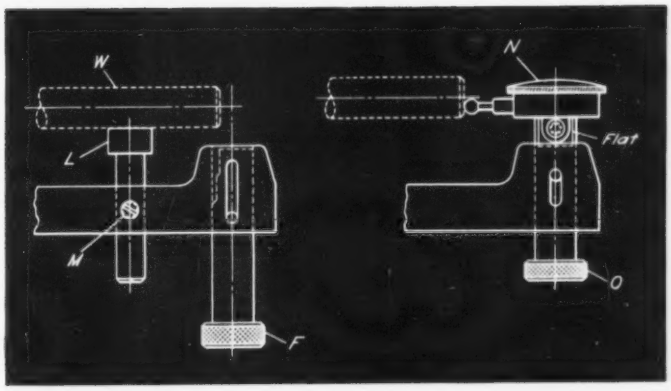


Fig. 2. Diagrams showing methods of using work-support and dial gage on equipment shown in Fig. 1 for finer precision checking

the bar *D*. A small lock-screw *M* in the bar is used to secure the rest *L* at the correct height to suit the diameter of the shaft being gaged. Before starting the repetitive checking of long shafts, the work-support *L* is set to the correct height to bring the shaft into axial alignment with the bore of bushing *B*.

When the tapered portion of a shaft must be held within closer tolerances in respect to length, the gage can be equipped with an ordinary dial indicator *N* seen in the diagram at the right, Fig. 2. The indicator is fastened to the end of a measuring pin *O*. Flats milled on the upper end of pin *O* permit the dial indicator to be centralized with *W* and attached as shown. The dial indicator is set to give a zero reading on a shaft known to have a correctly located conical portion of required dimensions. It is advisable to employ a master test shaft which can be kept on hand for use in all later inspection set-ups for duplicate work. By this simple means, readings of plus or minus 0.0005 inch can be made.

A small locking screw *P*, Fig. 1, is provided to take up any slack of the gaging pin *F* which may result from wear. By applying light finger pressure on screw *P*, the gaging pin is pressed against the left-hand side of its bearing hole, thereby maintaining uniform setting in the same relationship from block *A* regardless of any small amount of wear.

* * *

Vertical Chucking Grinder Demonstrated on Film

A black and white motion picture has been announced by The Bullard Company dealing with its vertical chucking grinder. This 16-millimeter silent film has a running time of about twelve minutes. Design features and present-day applications of this grinding machine are shown. The film is available without charge from the Advertising Department, The Bullard Company, Bridgeport 2, Conn.

Electrolytic Preparation of Molybdenum

Successful electrolytic preparation of molybdenum—a critical refractory metal for high-temperature applications—has been achieved by Drs. Seymour Senderoff and Abner Brenner of the National Bureau of Standards in a research program sponsored by the Army Ordnance Corps. These experiments have produced high-purity molybdenum by electrolysis of a bath of fused salts. The process is flexible and easily controlled. Depending on the conditions of electrolysis, deposits vary from fine powders to thick, coherent layers. With further development of the process, electroforming of molybdenum objects may become feasible. More rapid, less expensive methods for producing molybdenum parts and coatings, and for extracting the metal from the ore, may result from this work.

In recent years the need for heat-resistant materials in various applications has stimulated interest in refractory metals such as tungsten and molybdenum. At present, molybdenum is produced chemically as a powder by reducing purified molybdic oxide with hydrogen. This process is, however, expensive and has a number of other disadvantages. The molybdenum is obtained as a fine powder, and the size of the particles cannot be controlled. Because of the fineness of the powder, a large surface area is exposed to oxidation; extensive purification is thus required. Complicated powder-metallurgy procedures are also necessary to fabricate the powder into molybdenum objects.

These disadvantages may be eliminated by the electrolytic method, as the deposits are obtained directly on the cathode in the desired physical form and in a very pure state. Applications of the method for electrowinning, electrorefining, electroforming, and electroplating are under study. Electroforming would make possible the formation of molybdenum parts having complicated shapes.

Questions and Answers

A service to readers who have questions pertaining to the metal-working and machine-building industries

Salesman's Commissions on Unshipped Machine Tools

C.N.M.—Can a salesman collect commissions on orders for machine tools which his employer does not ship to the purchasers?

Answered by LEO T. PARKER, Attorney at Law, Cincinnati, Ohio

Yes, if the employer was obligated to make the shipments. A recent higher court held that an employer is liable in damages for failure to pay agreed commissions to his salesman on orders taken by the salesman and not filled by the employer. The amount of the damages is the full loss sustained by the salesman.

In Bright vs. Kalb [62 Fed. Supp. 815], it was disclosed that a manufacturer agreed in a written contract to pay a salesman stipulated commissions to sell merchandise. The salesman took orders which the manufacturer failed to fill. The higher court promptly held the manufacturer bound to pay the agreed commissions to the salesman. The same court also held that a contract is valid which states that the employer need not pay the salesman commissions on orders if the employer decides not to ship to the purchasers.

Can Heat-Treating Cycle of Aluminum be Reduced?

H.O.C.—Is it possible to reduce the time required for heat-treating 14S, 24S, and 75S sheet aluminum parts?

Answered by the Technical Editorial Service Reynolds Metals Co., Louisville, Ky.

Yes. Much depends upon the method of heating. Changing from recirculating air ovens to salt baths will shorten the heating period because of the higher rate of heat transfer.

The time at temperature ("soak" period) for any particular thickness of any aluminum alloy is not fixed by specifications. So it can be shortened to any point desired, provided it produces the required mechanical properties. Remember also, that the more closely the top solution temperature limit for any alloy can be approached, the shorter the soak time necessary to develop the specified mechanical properties.

The minimum heat-treating cycle can best be determined by trial. Select a heating method to bring the work up to temperature in shortest possible time. Shoot toward the top solution temperature limit. (Controls must be accurate to avoid over-heating.) Then vary the soak time, using a number of samples. Test the samples to reveal optimum cycle.

Cutting Depth of Grinding-Wheel Dresser

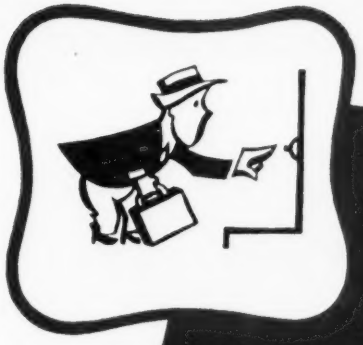
A.E.—In truing or dressing a grinding wheel with a diamond tool, what is the proper depth of cut per pass?

Answered by E. T. LARSON Norton Co., Worcester, Mass.

In dressing a grinding wheel, the proper cutting depth of the tool should be about 0.001 inch until the wheel is round. This procedure leaves a wheel face satisfactory for roughing. Heavy cuts tend to leave diamond marks on the wheel, heat the diamond excessively, and cause it to wear rapidly. For fine wheel finishes, lighter cuts should be taken.

Technical Movie—"The Turning Point"

Marking a departure from the conventional approach to machine tool promotion followed in the majority of strictly product-selling motion pictures, the Monarch Machine Tool Co., Sidney, Ohio, has produced an institutional type of technical film. This 16-millimeter color-sound motion picture, in a running time of thirty-three minutes, points up the "why" and the "how" behind modern lathe production in a machine tool plant, without covering industry-wide manufacturing methods and techniques. The picture shows the development of new equipment designs and focusses attention on quality control methods. Prints of the film are available on a loan basis if requested on a business letterhead.



The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

How One Buyer Rates Sales Engineers

WOMEN are said to have more intuition but less logic than men—in other words, they more often reach the correct conclusion without recourse to reason. In spite of this claim, while interviewing a woman purchasing agent last week, we were impressed with her logic in sizing up sales engineers.

This woman works for a progressive concern operating four plants that make a large variety and volume of precision-cast metal parts. She buys not only raw materials and supplies, but also factory equipment. Among her purchases are machine tools, which she selects in each instance from a few suppliers whose apparatus is approved by factory engineers.

"I classify every salesman who calls on me," she confided. "You might say each one occupies a secret pocket in my mind. In this way I can efficiently allocate my time. All get a hearing. But you know, some get my undivided attention for a considerable time, while others I find it best to cut rather short. How do I rate them?

"Dependability comes first, no matter if the salesman wears a moustache, talks with an accent, or is twenty-five or sixty-five years old."

What the purchasing agent implies is that the broken promise—whether it involves failure in complying with the details of the purchasing specification, meeting the shipping date, or giving prompt help in cases of trouble—is always a black mark.

"Concentration on the 'earth' and not on the 'sky' in his sales talk. I'm not here to be bewitched by some character on TV."

Many a salesman wastes the time of the purchasing agent by palaver. Often salesmen would have been better off had they started to talk long after they actually did. Of course, conditions do vary, but this purchasing agent has many callers and, conversely, limited time.

"Technical information and recommendations. That's what we like. It helps our engineers and shop people, and those of us who buy. We rate sales engineers high who give us engineering suggestions that help us do the job better and cheaper. Some of our equipment is rather old and out-of-date."

The well-informed sales engineer is the best friend the industrial buyer has. But only if he studies operations and thinks ahead to show how time and money can be saved and a better product finished.

"Commercial help. Do you think I ever forget the salesman who tips me off to a pending revision in price and delivery?"

In this instance, our buyer put her finger on the importance of the sales engineer being informed on the present and probable future state of the market. The buyer of a large variety of products may not be as well informed upon one single product as is the salesman.

"Honesty in approach. When a salesman doesn't know the answers, why does he try to deceive? When I don't know, I tell him. He should do the same."

This buyer pointed out that new salesmen often call. The way is open for them to reach engineers and production people to learn about the problems. But when they fail to dig in and find out, their sales message doesn't ring true and they deserve slight consideration.

"After all, what am I here for?" asked this woman purchasing agent. "Just to get the best of the products we need at a fair and competitive price, and in the quantity and at the time required. We welcome the salesman who helps us to do this. We give him as many orders as we possibly can—for he is the man that holds the top 'pocket' in my mind."

LATEST DEVELOPMENTS IN *Shop*

Farrel-Sykes "Twin-Head" Gear Generator

The Farrel-Birmingham Co., Inc., Dept. M, Ansonia, Conn., recently announced an improved gear-shaping machine called the Farrel-Sykes "Twin-Head" gear generator. Basically, this is a redesigned model of the Farrel-Sykes gear generator developed by the company more than thirty years ago. The new "Twin-Head" feature incorporates two cutters which are mounted with their cutting faces opposed, as shown in the diagram, Fig. 2. Both cutters are mounted on a single reciprocating carriage, the one cutter operating when the carriage movement is in one direction and the other cutter operating when the movement is in the opposite direction.

Each cutter ends its stroke when the cutting edges are at the center of the blank face. The combined rotating and reciprocating motion serves to generate the helices. The cutters also slowly

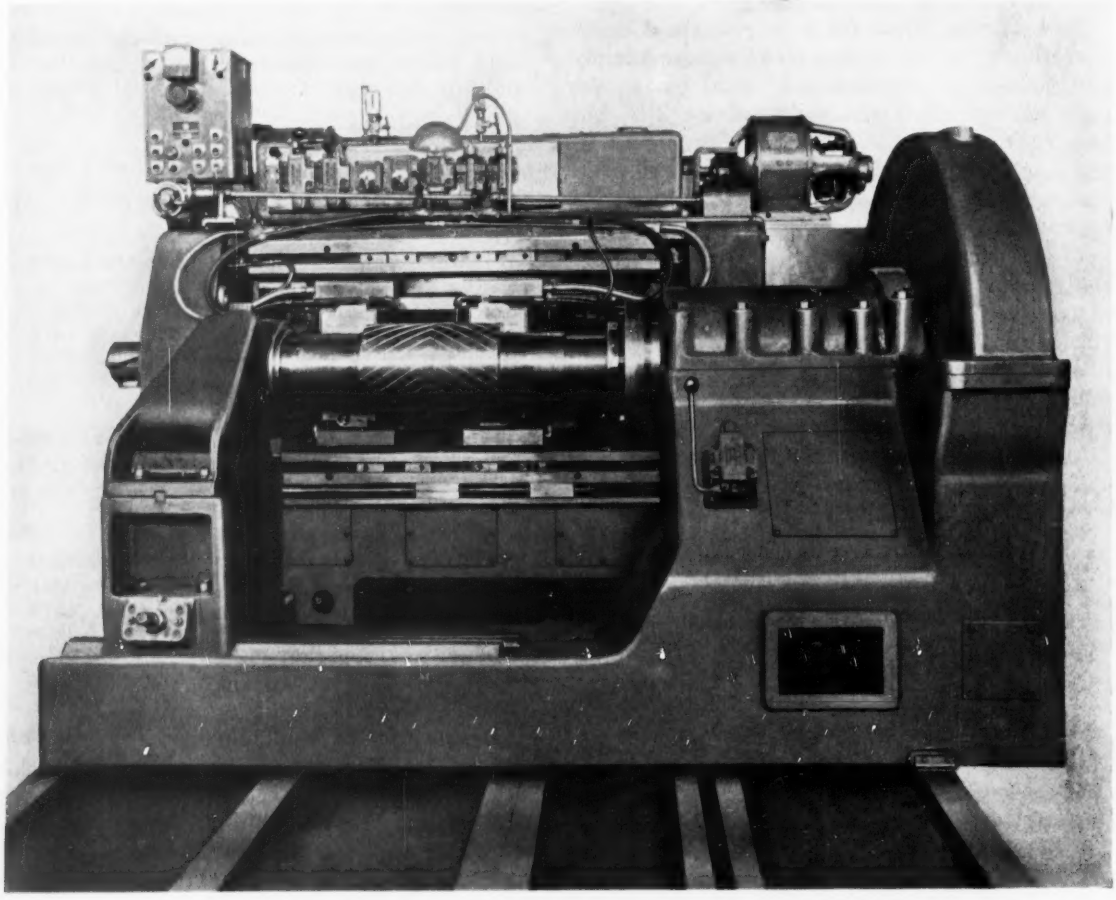


Fig. 1. Front view of Farrel-Sykes "Twin-Head" gear generator, showing start of cutting operation on continuous-tooth herringbone pinion with integral shaft

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

revolve in unison with the wheel blank, thus generating the tooth contours. Accurate finishing of the apex surfaces is a feature.

The main or work spindle is of large diameter and designed so that no appreciable torsional deflection can take place. It has a large bored hole for accommodating pinions integral with shafts. The spindle is interconnected with the rotary feed through change-gears. A special geared head fluid motor is provided for truing up the work. This motor is interlocked with the rotary feed motor so that the latter cannot be started when the worm is disengaged.

It is claimed that on this new machine gears can be cut at speeds up to one-third faster, and with higher accuracy and quality of tooth finish than on preceding models. One cutter will remove any burr left by the other cutter. As each cutter tooth recedes slowly from engagement with the gear tooth space it is generating, the chip tapers off to an infinitesimal thickness, thus leaving a clean finish at the junction of the two helices.

Provision for rapid selection of speeds and feeds, easy adjustment of cutters, positive control of infeed or depth of cut, and the hydraulic control system incorporated in the machine result in greater operator convenience. One of the important design changes is the use of a heat-treated main spindle and a heavy work saddle. The electronic speed and feed indicator enables the operator to read and quickly adjust the speed of the main crank, the traverse of the cutters, and the feed. Twin cutter-heads, with separate, shorter, stiffer spindles help produce gears with a more accurate involute rolling action. The cutters extend forward, facilitating the cutting of small-diameter pinions and pinions with long shafts.

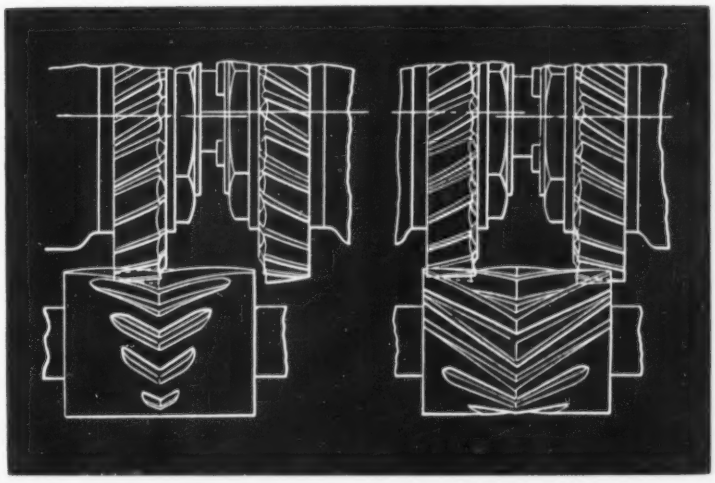


Fig. 2. Diagrams illustrating operating principle of "Twin-Head" gear generator shown in Fig. 1

In addition to continuous-tooth herringbone gears, the twin-head machine will cut double helical gears with a wide or narrow center groove, single helical, and straight-tooth gears. It can also produce cluster gears, angle gears, spiral gears, worms, and racks. When equipped with a special fixture, a wide variety of contours can also be machined. The machine is built in four sizes, the largest of which will cut gears up to 120 inches in diameter and with a face width of 30 inches.

Ipsen Cleaning Compound

A non-corrosive washing compound for quick, thorough removal of quenching oils from ferrous metals after heat-treating operations is announced by Ipsen Industries, Inc., Dept. M, 715 S. Main St., Rockford, Ill. This new Ipsen product, known as "Washing Compound 103," is designed for effective removal of lapping and drawing compounds as well as oil, grease, and lubricants. It is suitable for use in both batch and spray type washers. The degreasing agent is said to produce metallurgically clean work-pieces within three to ten minutes in circulating type washers.

Although only mildly alkaline, the compound will remove heavy oils and greases. It is non-caustic, will not harm skin or clothing, and will not corrode or etch finished metal parts. Because it is odorless and non-toxic, special ventilation is not required.

A modified compound, designated as Ipsen "Metal Washing Compound 107," provides increased solubility and is available for certain unusual conditions sometimes found in the use of spray type equipment. Because it is concentrated, less than 1 ounce of the washing compound is required per gallon of water.

Thompson Production Grinders

The Thompson Grinder Co., Dept. M, Springfield, Ohio, has announced a complete line of production surface grinders which includes sizes ranging from 12 by 48 to 24 by 168 inches. This line of machines, called the Type C, is designed for fast, accurate, and economical grinding of a large variety of parts—from a tool steel broach bar to the ways of a machine tool. The machines are equipped with grinding wheels 20 inches in diameter.

Cross-feeding of the horizontal spindle can be employed for grinding with the periphery of the wheel. An anti-friction elevating nut is employed to eliminate "wind-up" between nut and screw. Safety stops are provided for the power elevation and hydraulic rapid traverse movements.

The levers for controlling the speed and cross-feed of the hydraulically operated table are conveniently grouped in the operating area. The table speed is variable from 10 to 100 feet per minute, and the cross-feed is adjustable in increments of 1/32 inch to one-half the wheel width at each reversal of the table movement. Fast spark-out, small increments of down feed, and wide increments of cross-feed at a table speed of 100 feet per minute are said to provide high accuracy and a fine finish.

Heavy work-table supports with bedways twice the length of the table give extra rigidity. The cross-slide ways are flame-hardened. The motor is built into the wheel-head and mounted directly on the spindle. Other features include automatic lubrication; separate coolant system; and Bellows type covers for protection of slide ways and bedways.

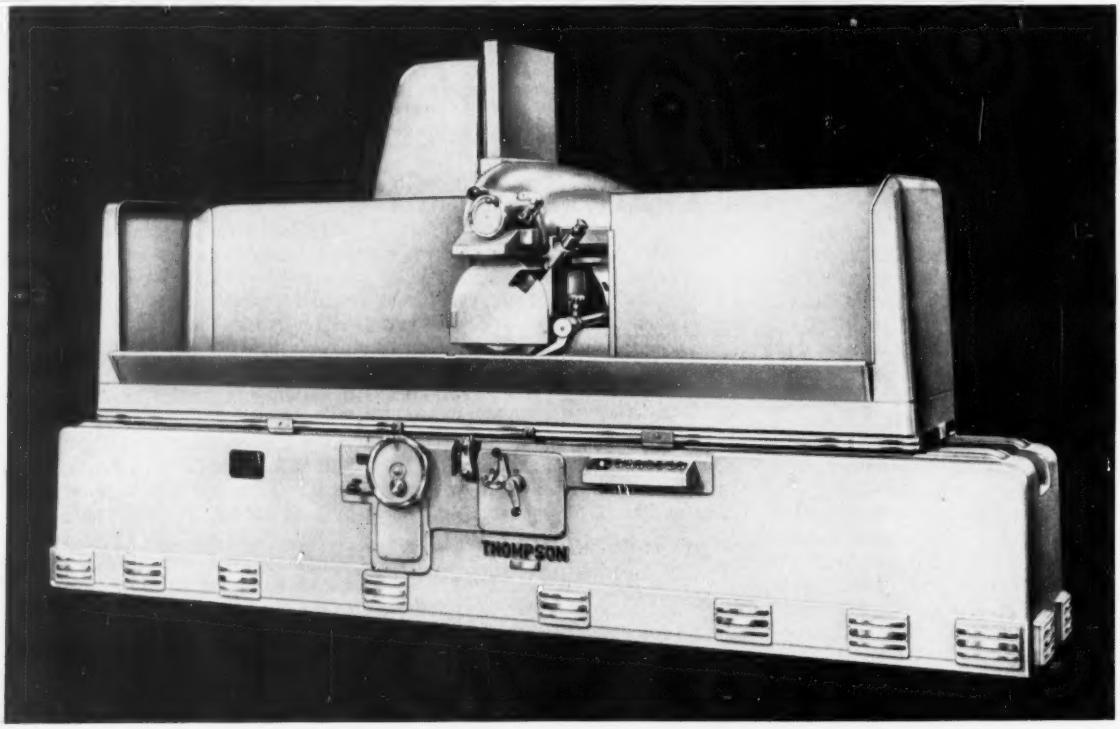
Auxiliary equipment includes an automatic down feed; a micrometer back-up stop; a dust exhauster; an arrangement for running coolant through wheel; tape bedway covers; a hand table feed; "Hoglund Magniform" contour dressers; a coolant filter; and magnetic chucks.

Colonial High-Speed Broaching Machine and Automatic Broach-Handling Equipment

A high-speed broaching machine and equipment for the automatic handling of broaches for two-pass broaching operations are recent developments of the Colonial Broach Co., Dept. M, Box 37, Harper Station, Detroit 13, Mich. The double-acting mechanically driven, electrically controlled broaching machine with hydraulically actuated fixture, Fig. 1, is designed for a wide range of broaching operations. This 25-ton Model HM-25-130 machine has a maximum stroke of 130 inches. The ram is 24 inches wide and its speed is infinitely variable from 30 to 150 surface feet per minute in either direction.

Various types of work-table construction, such as trunnion, rotary, and shuttle, can be used on this machine. A jog control panel is provided for use in set-up and tryout work. All electrical and hydraulic equipment is installed in accordance with J.I.C. standards. Automatic pressure lubrication is used throughout and the ways are hardened and ground. The drive for the ram is supplied by a direct-current motor rated at 150 H.P., at 750 R.P.M.

The first machine of this line was equipped, as shown in Fig. 1, for broaching close-grained cast-iron bearing cap clusters for a V-8 engine at a speed of 142 sur-



Production type grinder brought out by the Thompson Grinder Co.

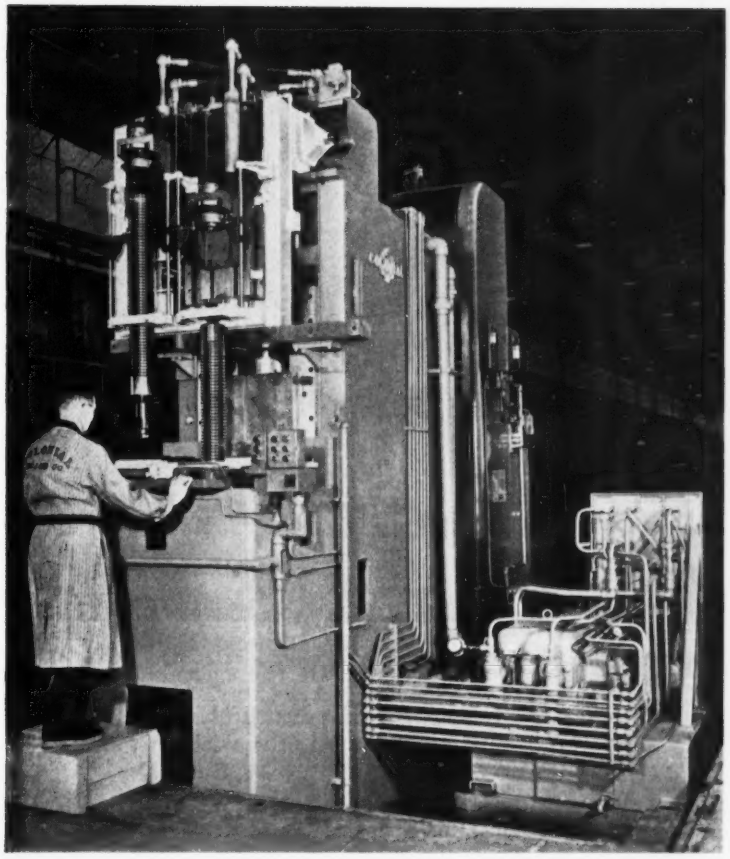


Fig. 1. Colonial high-speed mechanical broaching machine equipped for two-pass broaching cycle on automotive bearing cap clusters

face feet per minute. Carbide insert broaches cut on both the initial and return stroke, removing stock from two bearing cap clusters. Metal is removed at a rate of 3 1/4 pounds per cycle, with the depth of cut varying from 5/32 to 3/16 inch. The time for each cycle is twenty-one seconds, giving a normal production of 210 clusters (each consisting of five bearings) per pour.

Increased production and reduced handling are advantages claimed for the ingenious broach-handling arrangement illustrated in Fig. 2. This set-up on a Colonial 50-ton, 72-inch stroke, pull-down broaching machine enables large components requiring two passes to be broached internally from start to finish with a minimum handling of work and broach. A similar arrangement can be used for the internal broaching of involute splines, straight splines, squares, rectangles, and irregular shapes. Normally, such parts must be handled four times. With the dual sliding broach-handling support, the part to be broached is placed on a hydraulically actuated receding table and requires no further handling until completion of the cycle. The finished part is then removed.

To start the cutting cycle, the operator depresses buttons at both sides of the control, his hands be-

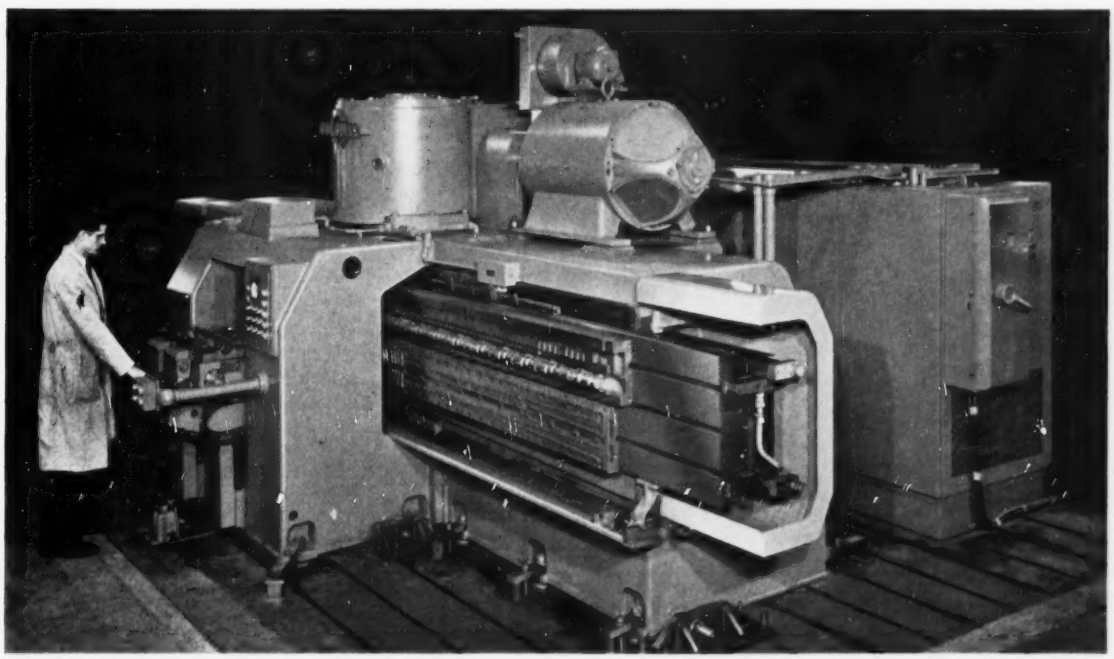


Fig. 2. Colonial two-pass broaching machine equipped with automatic broach-handling equipment

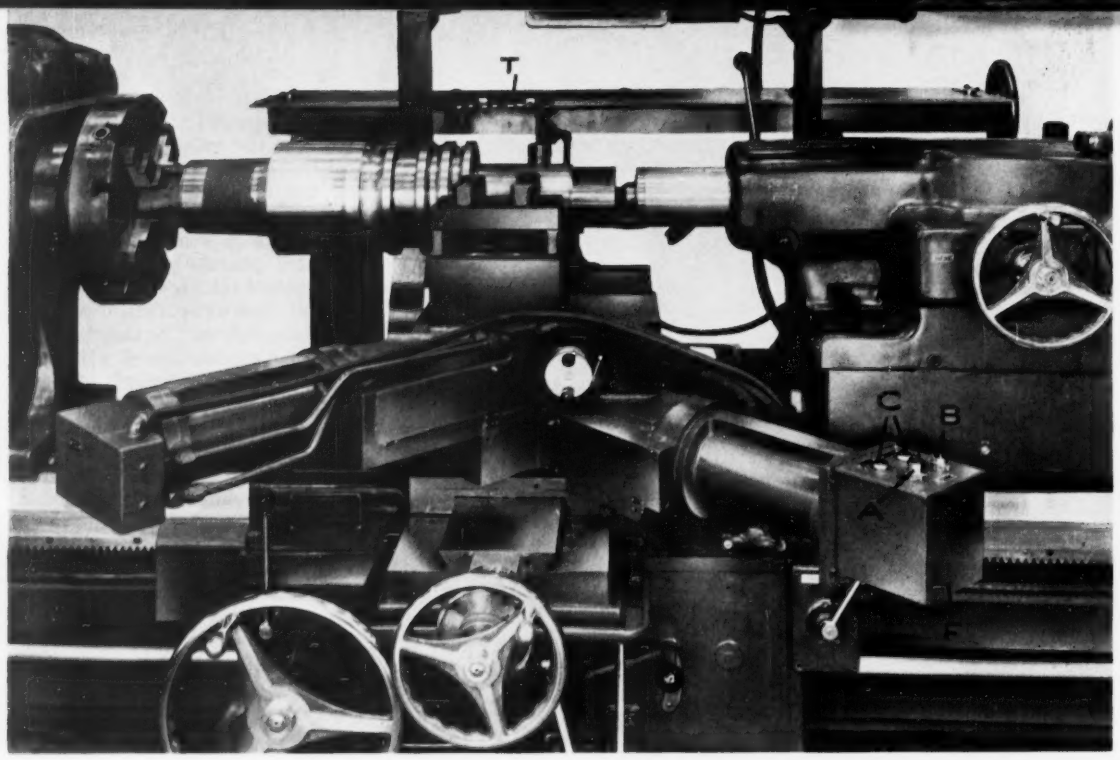


Fig. 1. "American" hydraulic roll-duplicating lathe equipped with automatic cylinder selecting device

ing clear of the machine. Once the cycle is started, the receding fixture brings the part into the cutting position. The broach for the initial pass is pulled through the part; the fixture recedes to clear the broach; and the broach is returned to the handling puller at the top of the machine.

The dual sliding broach-handling support then shuttles to the left, carrying the second, or finishing, broach into the cutting position. Next the table moves into the cutting position and the finishing pass is made in the same manner as the initial pass, including return of the broach to the pullers. The support then shuttles to the starting position and stops automatically, ready to begin another cycle.

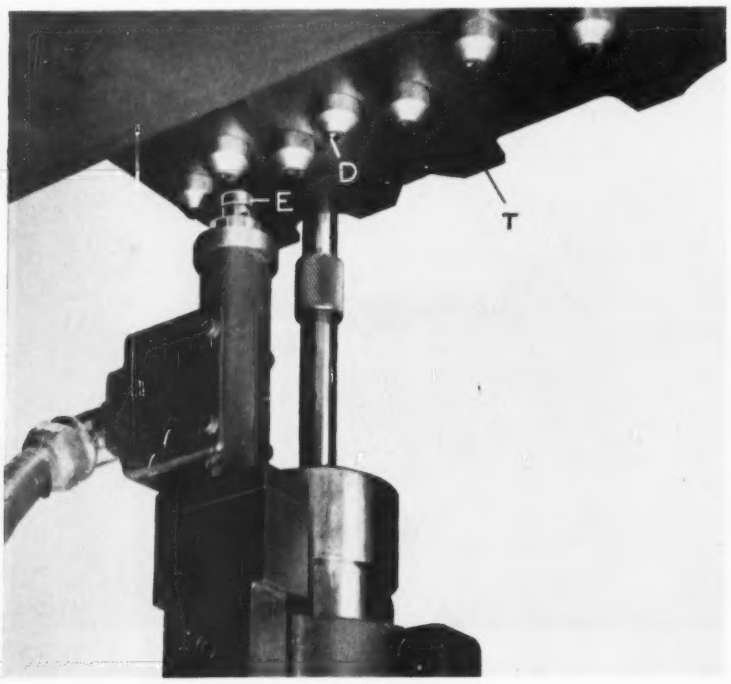


Fig. 2. Close-up view of template (*T*) equipped with contact buttons for operating cylinder selector mechanism in control box (*F*), Fig. 1

Hydraulic Roll-Duplicating Lathe with Automatic Control

An automatic, electrical device of unique design has been added to the hydraulic roll-duplicating lathe manufactured by the American Tool Works Co., Dept. M, Pearl St. at Eggleston Ave., Cincinnati 2, Ohio. This device, actuated by the template shown at *T* in Figs. 1 and 2, automatically selects the correct operating cylinder for proper control of the profile turning tool, and instantly makes the change from one cylinder to the other at the right time, thus relieving the operator of the necessity for performing this operation manually.

Contact buttons *D* are located at predetermined points on the template, as shown in Fig. 2. When the contactor *E* touches one of these buttons, the automatic selector mechanism, located in the control box *F* attached to the hydraulic cylinder shown at the right of the carriage in Fig. 1, is energized and the change from one cylinder to the other occurs. This eliminates the danger of the operator failing to make the

Fig. 1. "Red Ring" internal gear shaving machine announced by the National Broach & Machine Co.

change manually from one cylinder to the other at the right time. This arrangement does not mean, however, that the operator ceases to have control of the two cylinders.

The automatic feature does not replace the manual control. A selector switch *A*, located on the control box *F*, provides selective means for either manual or automatic cylinder control. When the manual control is engaged, the push-button *B* controls the cylinder selection. Regardless of the control being used, lights *C* indicate which cylinder is in actual operation.

"Red Ring" Gear-Shaving Machine for Internal Spur or Helical Gears

A "Red Ring" gear-shaving machine for precision shaving operations on internal spur and helical gears having pitch diameters of from 3 to 12 inches is announced by the National Broach & Machine Co., Dept. M, 5600 St. Jean Ave., Detroit 13, Mich. This model GCR machine, shown in Fig. 1, is designed specifically to finish only internal gears. It will shave gears up to 4 diametral pitch and 2 1/2-inch face width.

Features of this new machine include a work-head that permits taper-shaving operations with an optional pivoting arrangement, illustrated in Fig. 2, that facilitates loading and unloading of internal gears such as those having wide faces or long integral shafts. A precision "Red Ring" differential automatic up-feed mechanism includes a master cam that acts as a step gaging device to accurately control feed increments, finished size, and return to backlash position. High-production plunge-cut shaving (cutter feed without work or cutter reciprocation) is optional.

The shaving action is accomplished by the crossed axes principle, the work being mounted on

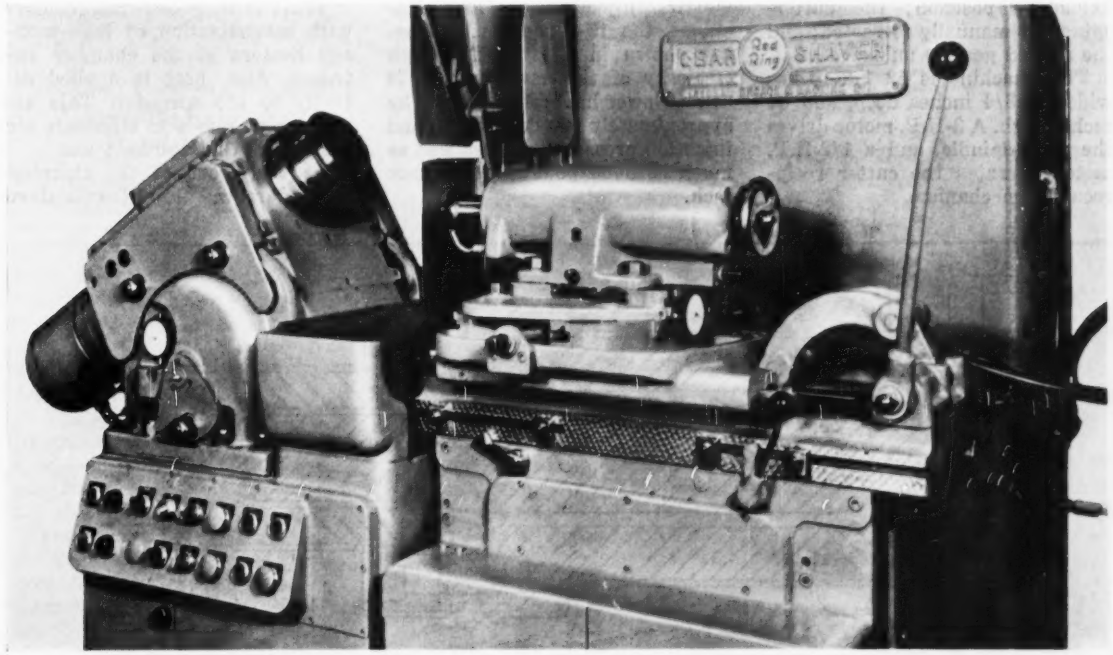


Fig. 2. Close-up view of the gear shaver, Fig. 1, showing how the work-head pivots to facilitate loading and unloading of internal gears having either wide faces or long integral shafts

a driving head with its axis in a horizontal plane. A gear-shaving cutter engages the work gear with the cutter-spindle center line set at a crossed axis angle with the work gear. Either the conventional or plunge-cut shaving method can be used. With the former method, the work drives the cutter and the cutter is reciprocated across the work face. The cutter is automatically fed vertically at the end of each stroke and allowed to dwell at the finished depth before being retracted. When the latter method is used, the work drives the cutter but the cutter is fed to depth without reciprocation.

The gear to be shaved is loaded in the work-head and clamped in position by either manual or automatic locking means, depending on the type of work-holding fixture. Then, if necessary, the head is pivoted to the horizontal shaving position. The cutter is next manually advanced to engagement with the work gear by the cutter-spindle control lever while being simultaneously oriented by rotating the spindle handwheel.

The cycle start-button is actuated and the machine begins an automatic cycle of work rotation, cutter reciprocation, automatic cutter-spindle up feed in selected increments, and return to backlash position. At the end of the cycle the machine stops; the work is pivoted, if necessary, up to the unloading position; the cutter-spindle is manually retracted; and the shaved gear is unloaded.

This machine is 62 1/2 inches wide, 39 3/4 inches deep, and 64 inches high. A 3-H.P. motor drives the work-spindle, and a 1/2-H.P. motor operates the cutter reciprocating mechanism.

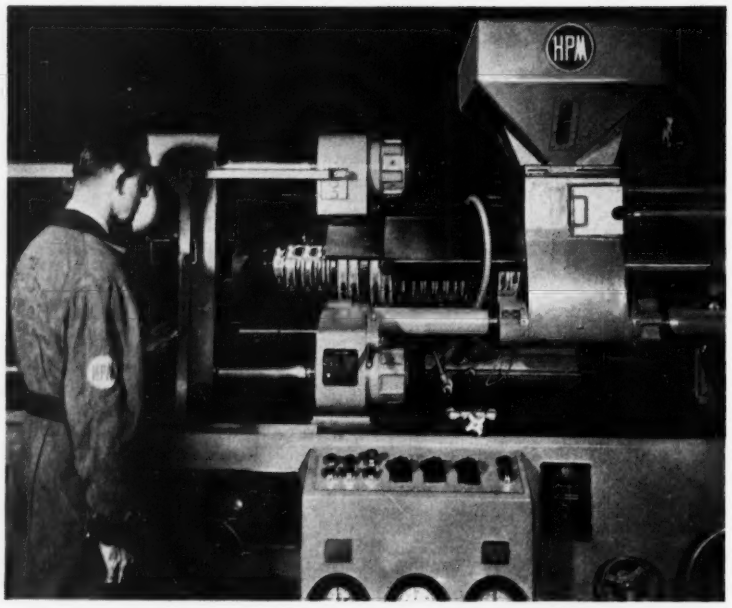


Fig. 1. H-P-M injection molding machine with new heating chamber

Plastics Injection Molding Machines Equipped with New Heating Chamber

A heating chamber designed to increase the plasticizing capacity of injection molding machines has been announced by the Hydraulic Press Mfg. Co., Dept. M, Mount Gilead, Ohio. This heating chamber is now standard on the company's 9-, 16-, 32,- and 60-ounce plastics injection molding machines, the 16-ounce machine being shown in Fig. 1. The high efficiency of the new chamber is said to lower heat requirements by approximately 100 degrees F., and injection pressures are reduced as much as 3000 pounds per square inch.

Field tests have shown that the chamber, illustrated in Fig. 2, makes possible a 40 per cent saving in cycle time. In addition, it increases the speed with which changes can be made from one color to another and also results in much easier mold filling.

There is three-zone heat control with concentration of high-wattage heaters at the chamber entrance. Also, heat is applied directly to the spreader. This arrangement serves to eliminate air gaps and resultant heat loss.

At the heart of the chamber are narrow, high-temperature

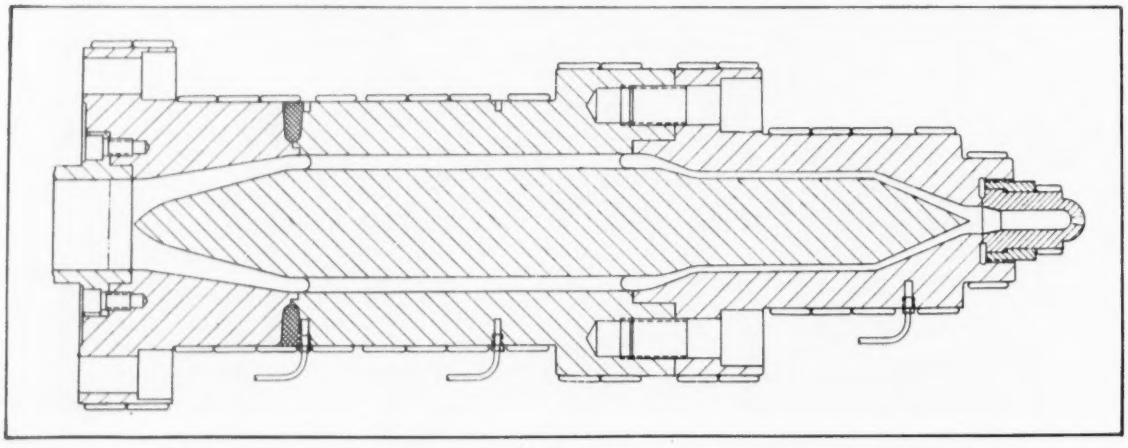
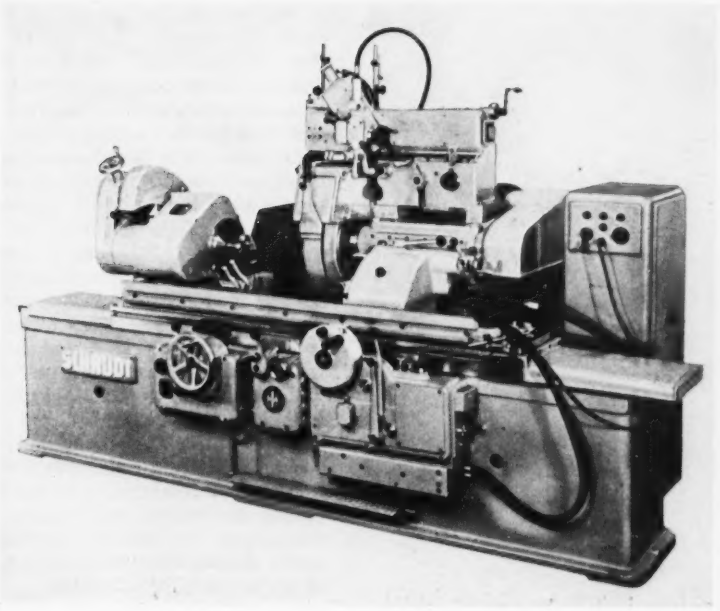


Fig. 2. Cross-sectional view of heating chamber of plastics molding machine shown in Fig. 1



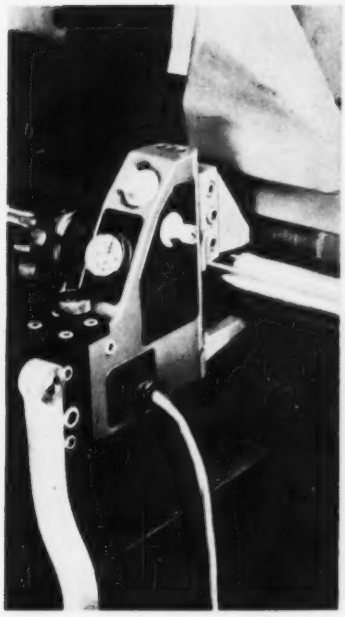


Fig. 1. (Left) Schaudt MPS cylindrical grinder with automatic sizing control recently introduced in this country by the Kurt Orban Co., Inc. Fig. 2. (Right) Close-up view of automatic sizing control of machine illustrated which compensates for thermal expansion and wheel wear.

heating bands with stainless-steel clamps that provide excellent contact with the chamber. An improved terminal block—mounted directly on the chamber—eliminates the need for long wire leads. The chamber is easily dismantled for cleaning, and is well suited for handling all modern thermoplastic materials.

Carboloy Cemented-Carbide Unground Die and Mandrel Nibs

A standard line of unground cartridge case die nibs has been brought out by the Carboloy Department of General Electric Co., Dept. M, Detroit 32, Mich. These nibs are available in four hole diameters, from 0.290 to 0.780 inch, and are stocked in Grade 779 Carboloy cemented carbide ready for delivery.

Also announced was a line of cemented-carbide unground braze type mandrel nibs for drawing steel, aluminum, and other tubing materials.

These new Carboloy nibs are stocked in seventeen sizes ranging from 0.450 inch to 1.250 inches in diameter. This range of sizes enables users to select an over-size nib that can be easily and quickly machined to size within the required tolerances.

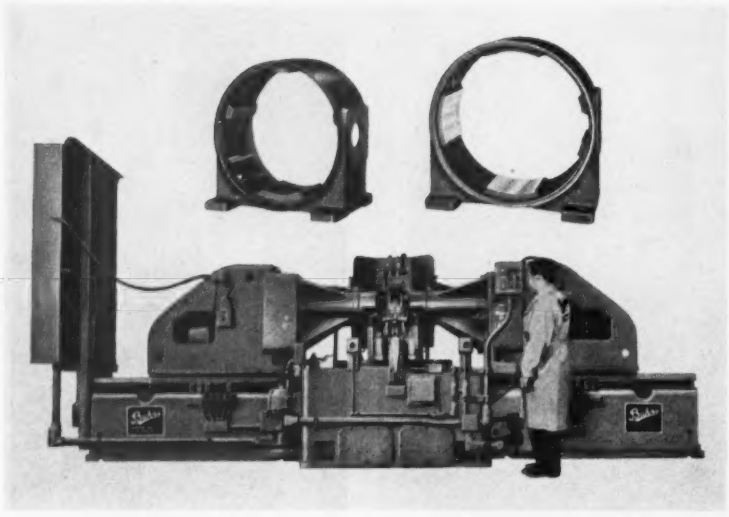
Precision Cylindrical Grinder with Automatic Sizing Control

Automatic sizing control of cylindrical grinding operations within accuracy limits of 0.00008 inch for concentricity on long runs, with full compensation for wheel wear, and thermal expansion are features claimed for the Schaudt MPS grinder now being distributed and serviced in the United States by the Kurt Orban Co., Inc., Dept. M, 205 E. 42nd St., New York 17, N. Y. The automatic sizing cycle, which is repetitive for each work-piece, is initiated by a single control lever. The wheel-head advances in rapid traverse to the working position and the work-spindle begins to rotate. If traverse grinding is to be performed, hydraulically controlled traverse of the table also starts.

An infeed that has been pre-set to about 0.006 inch above the required finished dimension is then engaged, and the sizing head, which carries two contact jaws riding on the work diameter, is swung into position by hydraulic action. When the first contact jaw is actuated, the machine automatically changes from coarse to fine feed, which is variable between 0.00002 and 0.00016 inch. The second contact in the sizing head is actuated when the final dimension is reached, and the machine stops automatically at the completion of the table traverse to the left. The sizing head is then retracted 4 inches and lowered 1 1/2 inches to permit easy removal of the work-piece and chucking of the next one.

Progress of the work cycle can be observed on colored indicator lamps. A green lamp lights during coarse feed, a yellow during fine feed, and a red just before the machine stops at the end of the automatic cycle. The sizing control is adaptable to work from 3/16 inch to 4 inches in diameter and to either traverse or plunge-cut grinding. If desired, the machine can also be used for grinding against dead stops, with a sparking-out period which is infinitely variable up to two minutes.

The Type MPS grinder is built in four models: No. 500, with a maximum distance between centers of 20 inches; No. 750, 30 inches; No. 1000, 40 inches; and No. 1500, 59 inches. All models have a center height of 8 inches. The work-head has eight spindle speeds from 12 to 300 R.P.M. and the grinding wheel has a speed of 1100 R.P.M. A fully automatic hydraulic form dressing attachment can be supplied as optional equipment.



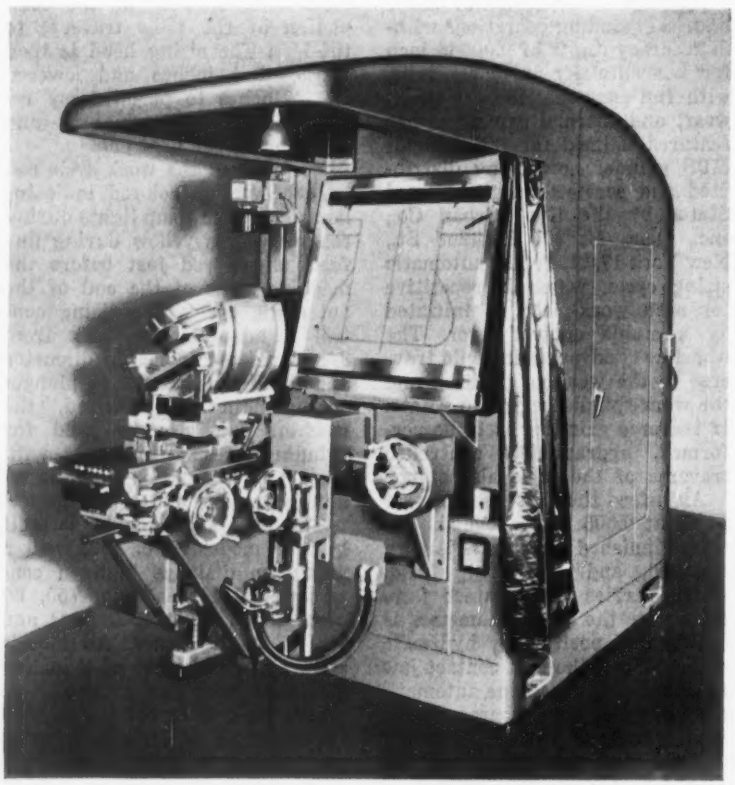
Machine for processing stator frames built by the Buhr Machine Tool Co.

Special Three-Way Boring, Facing and Tapping Machine

A special three-way boring tapping, and facing machine built by the Buhr Machine Tool Co., Dept. M, Ann Arbor, Mich., for a large electrical appliance manufacturer is here shown. This machine is designed to process eight different stator frames at the rate of sixty pieces an hour as they are received from another Buhr special machine that mills, drills, and reams the four legs, and drills the four conduit box holes.

The part is placed in the fixture at the loading station of the machine illustrated. The fixture is then automatically indexed 180 degrees into a position where two opposing spindles finish-bore the stator hole and perform facing operations while four conduit box holes are being simultaneously tapped by a tapping unit mounted in the rear of the machine.

Among the features of this machine are hardened and ground laminated tool-steel ways; automatic way lubrication; tapping spindles of the lead-screw type, with precision-ground chromium-plated threads; electrically controlled, automatically indexed tables of the cam-and-roller type designed to assure uniform acceleration and deceleration of the indexing movement; and location of components by dowels in holes bored to close tolerances to permit interchangeability of parts.



Optical comparator for inspecting slots in gas turbine discs brought out by the Jones & Lamson Machine Co.

Jones & Lamson Comparator for Inspecting Slots in Gas Turbine Discs

An optical comparator designed to inspect the contour, angular locations, and spacing of slots on gas turbine discs from 12 to 36 inches in diameter has been added to the line of precision inspection equipment made by the Jones & Lamson Machine Co., Dept. M, Springfield, Vt. For the convenience of the operator, the receiving screen of this comparator is located at one side of the work-holding fixture and at eye level. Finger-tip control of the hydraulically operated vertical travel of the work-table is obtained with a servo mechanism. The 30- by 30-inch receiving screen is of sufficient size to permit the use of projection lenses of suitable area to encompass most slots at magnifications of 31, 25, or 50 times the actual size.

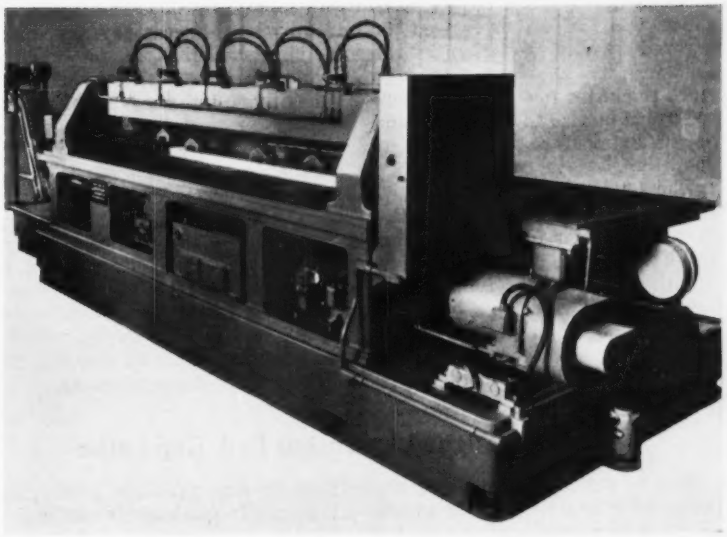
The staging fixture with sine-bar arrangement is rigidly constructed for supporting heavy discs. It provides an extremely accurate means for tilting the disc either right or left up to 50 degrees for inspecting the slot angle, and up to 15 degrees for checking the angular position of the slot face with respect to the axis of the disc.

Slot spacing measurement is accomplished with a graduated ring and vernier. Any inaccuracies in slot spacing are indicated by the relationship of the shadow of the slot to the chart outline.

High-Speed Saw for Cutting Aluminum Plates

The Motch & Merryweather Machinery Co., Dept. M, Penton Bldg., Cleveland 13, Ohio, has brought out a high-speed plate saw designed for the accurate cutting of aluminum plates up to 4 inches thick by 12 feet long. Coolant sump, chip compartment, and chip conveyor are built into the base of the machine. The hydraulic tank and pump with its motor are in a centrally located recess. The surface of the saw plate is equipped with free rollers having small cylinders that are actuated hydraulically to raise the stock from the surface of the table. This enables the operator to position the stock more easily. Rollers are provided for moving the plate in two directions, each set of rollers being independently controlled by the operator.

The stock is held in place by a heavy rail to which clamping pressure is applied by hydraulically actuated hold-down clamps. These clamping units can be positioned along the rail in the most effective positions, depending upon the length of stock. Each clamp has a shut-off valve so that it can be made inoperative if not needed. A single-speed saw head is mounted on a dovetail slide beneath the table. Variable feed for this head is provided by a feed-screw and nut arrangement operated by a variable-speed driving unit at the right-hand end of the table.

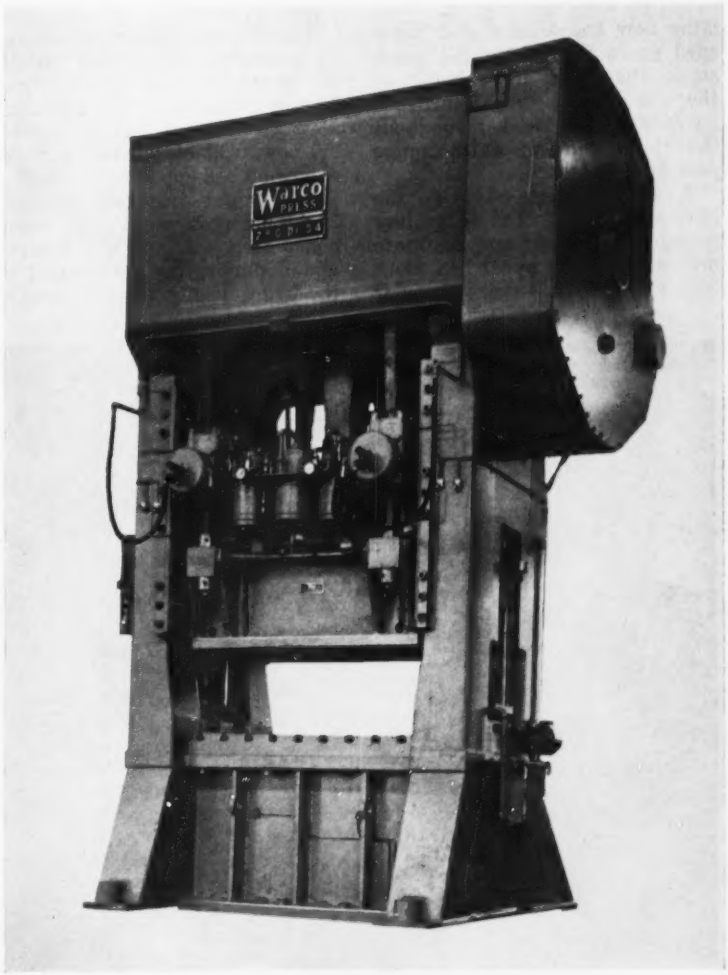


Motch & Merryweather high-speed plate saw

Force Adjustment Device for Double-Action Press

The Federal Machine & Welder Co., Dept. M, Warren, Ohio, has developed a Warco hydro-pneumatic force adjustment device to protect presses from damage caused by overloads. This simple, compact unit applied to a double-action press, as shown in the illustration, acts as a safety overload protection for the blank-holder. It also provides a means for independently adjusting the blank-holder pressure at each of the four corners, making it possible to apply pressure up to the capacity of the device at any selected corner.

With the conventional rigid blank-holder it is often difficult to regulate the pressure, this being accomplished by mechanically adjusting the point at which the blank-holder meets the blank. The



Double-action press of 250-ton capacity equipped with Warco hydro-pneumatic force adjustment device

blank-holder tonnage or holding effect will be either raised or lowered by any variation in the thickness of the blank, due to stock thickness tolerances that are too broad or else to the thickening of the blank during the drawing operation.

The tendency in making draws with double-action presses is to set the blank-holder for the minimum blank thickness, thereby increasing the blank-holder tonnage for the average blank. This increases the drawing tonnage and has a detrimental effect on the life of the press, the dies, and the material being drawn. In the event that redrawing is necessary, too great a blank-holder tonnage induces excessive elongation and cold working, which may make it necessary to perform an annealing operation or may cause a fracture in the drawn part.

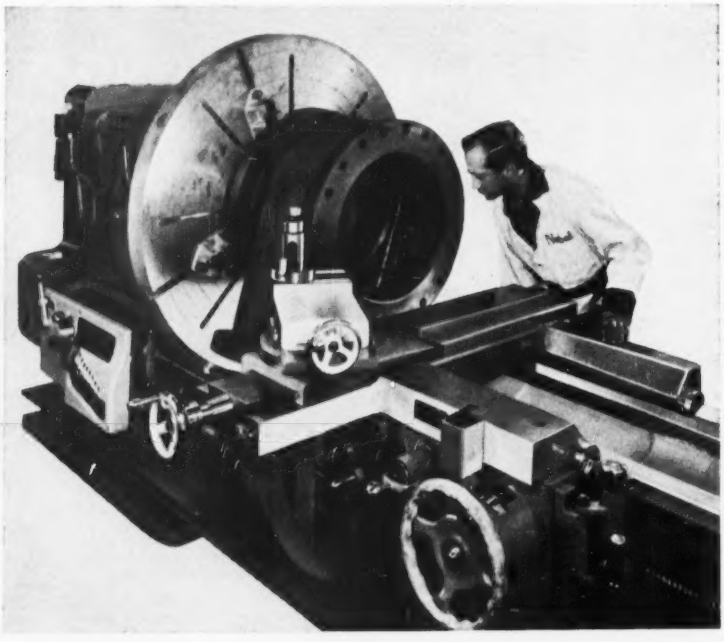
The Warco force adjustment unit makes it possible to determine the blank-holder pressure required at each corner, and to duplicate this setting whenever the job is re-run. In case of double blank feeding, the device will detect the double blank and stop the press before damage occurs.

Nebel Redesigned Extension Bed Gap Lathe

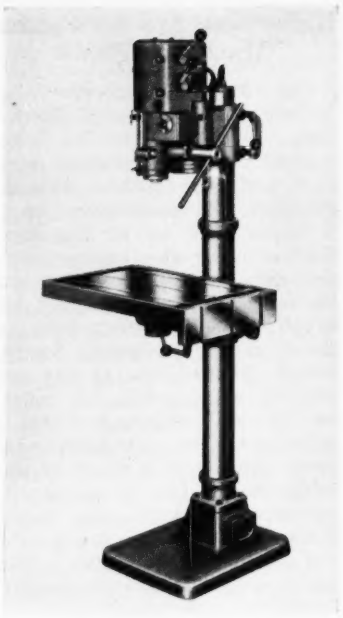
The 'G' series extension bed gap lathe with a swing of 52 inches through the gap and 20 inches over the carriage, manufactured by the Nebel Machine Tool Co., Dept. M, Cincinnati 25, Ohio, has recently been redesigned. This lathe now has shaved and hardened gears throughout the headstock, the drive gears being of the cut helical type. Hardened gears are also used throughout the apron and the quick-change gear-box.

A vee has been added to the rear of the lower bed to achieve accurate alignment and facilitate movement of the upper bed. Both beds are now 75 per cent heavier than in the previous lathe. The tailstock is also heavier and larger, having a spindle 4 1/4 inches in diameter and a spindle traverse of 10 1/2 inches. This lathe is now arranged for operation with a 25-H.P. motor.

The 'G' series lathe is also made in a smaller size, which swings 40 inches through the gap and 15 1/2 inches over the carriage. New attachments and accessories are now available for use on Nebel extension bed gap lathes including power rapid traverse, dynamic braking motor, replaceable hardended steel carriage way inserts, and a duplicating attachment of the hydraulically actuated type.



Redesigned extension bed gap lathe placed on the market by the Nebel Machine Tool Co.



Geared-head drilling machine being produced by I. O. Johansson Co.

Geared-Head Drilling Machine

A completely gear-driven drilling machine is now being manufactured by the I. O. Johansson Co., Dept. M, Skokie, Ill. Quick changing of speeds on this machine, even while running, is accomplished by a simple shifting of gear levers. A unique spindle construction, with the lower bearing located at the nose, gives rigid support. Quick tool changes are possible through the use of a built-in automatic drill ejector.

Two stops are provided for precision depth drilling and counterboring. One stop on the left-hand side of the head is for fine adjustment to the correct depth, while the other stop on the right-hand side is employed to insure maintenance of the original setting. The entire head can be swiveled 360 degrees around the column and locked in position by a handle for rapid hole location.

Eight spindle speeds from 125 to 1540 R.P.M. are provided through a selective gear-box and a 1-H.P. motor drive. The No. 3 Morse taper spindle has a travel of 4 1/2 inches and will drill holes spaced on a circle 18 inches in diameter. With a drilling capacity of 1 inch in steel, the maximum distance from spindle to table is 34 inches and from spindle to base, 49 inches.

DoAll High-Speed Band-Sawing Equipment

The capacity of the band-sawing machine for performing slotting, slitting, shaping, notching, and similar operations on production parts of alloy steel and other tough metals and materials has been greatly increased by new equipment developed by the DoAll Co., Dept. M, 254 N. Laurel Ave., Des Plaines, Ill. This equipment, including the "Demon" high-speed steel saw band and a new line of unique semi-automatic band type machines, will be demonstrated in the DoAll exhibit, Booth 1503, during the coming A.S.T.E. convention in Philadelphia, April 26 to 30.

The DoAll Demon band, said to be the first high-speed steel blade available to band saw users, is now being produced in two tooth styles, three varieties of pitch, and five different widths ranging from 1/4 through 1 inch. The buttress type tooth, originally developed for larger work sections, is now offered also in a Demon buttress style in three different pitches and three widths, 1/2 through 1 inch. Its red heat hardness (common to high-speed steels) permits two to three times greater band tool velocity than is possible with the high-carbon steel blades previously employed. The greater tensile strength of the new blade also allows heavier work feeds and chip loads without sacrificing accuracy.

Fig. 1. Semi-automatic band machine brought out by the DoAll Co.

The semi-automatic band machines have hydraulically actuated movements and adjustments, such as table feeds, feed pressure, variable tool speed control, guide post adjustment, automatic band tensioning, and table tilt. Increased horsepower assures continuous

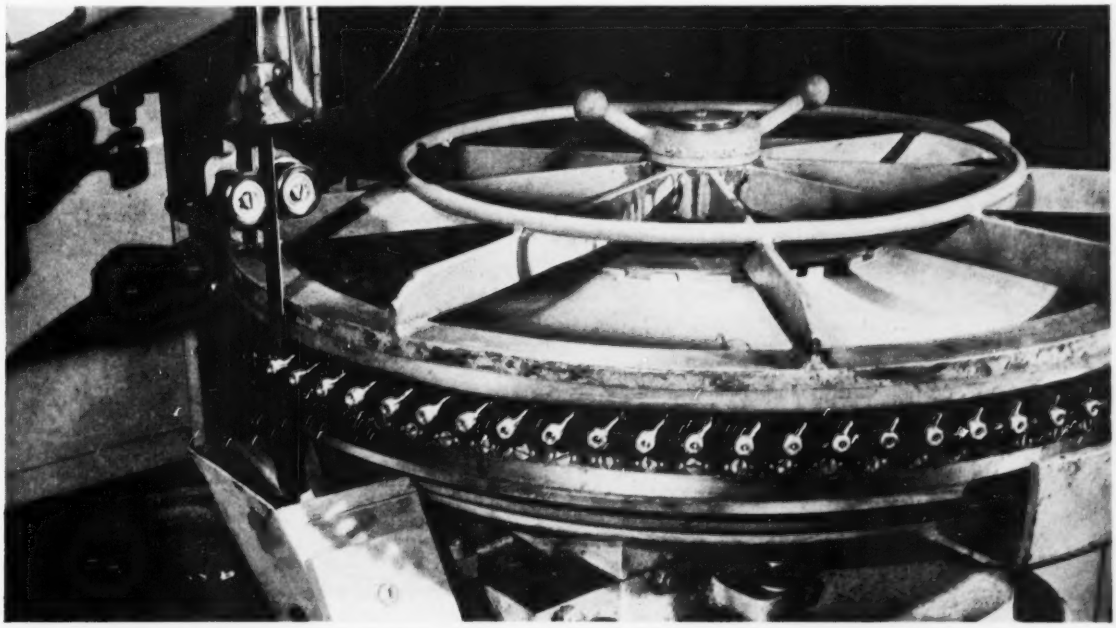


Fig. 2. Close-up view of DoAll band machine equipped for trimming operation on jet blades

production under heavier cutting loads. Greater ruggedness and rigidity serve to reduce vibration.

Push-button operation from a centralized control panel is made possible by sensitive hydraulic power feeds and other controls. Feed rates and pressures are readily adjustable to the values best suited for the material being machined. Saw guide post adjustment, automatic tool tensioning, and table positioning for angular cuts are hydraulically actuated adjustments under push-button control.

In most precision slotting and parting operations, the use of simple fixtures and elimination of clamps in conjunction with hydraulic power feeds afford such rapid cutting that the speed of the operator in loading and unloading the fixture is the only limitation. Integral coolant facilities provide for flood, mist, or air-jet cooling.

One feature of the band machines is versatility, which makes it possible to substitute a different band for the saw band in such operations as filing, slicing, grinding, polishing, and carbide tool finishing. For example, Fig. 2 shows a close-up view of a trimming operation on jet-engine turbine wheels being performed on one of the new band machines. This is a "friction sawing" process in which the band is run at a high velocity so that the metal just ahead of it is softened. This permits the machining of hardened, tough alloy metals.

Edlund Variable-Speed Drilling and Tapping Machine

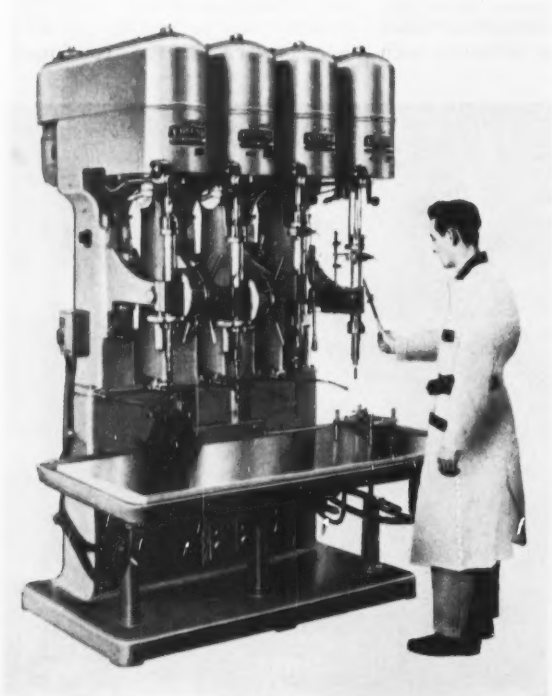
The Edlund Machinery Co., Dept. M, Cortland, N. Y., has designed and built a variable-speed drilling and tapping machine to suit actual tool-room and customer shop requirements, which is said to have increased production by as much as 25 per cent. Hand-lever control of the infinitely variable speed drive of this Model 2F machine allows the operator to select the correct speed instantly. An indicating dial shows the speed selected.

Spindle speeds range from 200 to 3600 R.P.M. This includes a low range of 200 to 1200 R.P.M. and a high of 600 to 3600 R.P.M. with three intermediate speed ranges. A back-gear attachment is also available which gives an additional range of speeds from 50 to 900 R.P.M. The drilling capacity of the machine, using back-gears, is 7/8 inch in steel and 1 1/4 inches in cast iron. Models with 8- and 15-inch overhang and from one to eight spindles are available in the pedestal type machine. Round column machines with the same overhang are also included in the line.

Equipment available for this machine includes the back-gear attachment; a semi-automatic power feed that engages automatically as the drill touches the work; a reversing motor tapper, capable of tapping thirty holes per minute and reversing at the same depth within a quarter turn of the tap; an Edlund lead-screw tapper, with adjustable stops and interchangeable pick-off gears; and a gusher coolant system.

Analytical Comparator Designed for Rapid Gear Checking

An analytical comparator recently announced by the Illinois Tool Works, Dept. M, 2501 N. Keeler Ave., Chicago 39, Ill., has been developed to provide means for making a quick, accurate, and



Variable-speed drilling and tapping machine brought out by the Edlund Machinery Co.

Illinois Tool Works analytical comparator for rapid checking of production gears

low-cost analytical comparison check on production gears. This gear-checking machine was styled by the industrial design firm of Reinecke & Associates in collaboration with engineers of the Illinois Tool Works. It is adapted for use by both large- and small-volume gear producers and offers a less expensive method of analysis than that involving a complete analytical check with separate involute, tooth space, and helical lead checking machines.

The comparator provides a permanent, easy-to-read record which reveals all variations between a master gear and the production gear being checked. This graphic recording is said to show the true condition of the inspected surface, indicating just where the errors originate.

The machine has a table motion parallel to the axis of the gear for checking the lead. A perpendicular motion checks the involute or tooth profile, and the in-and-out motion of the indicator slide checks the tooth spacing.

Turner Automatic Piston-Milling Machine

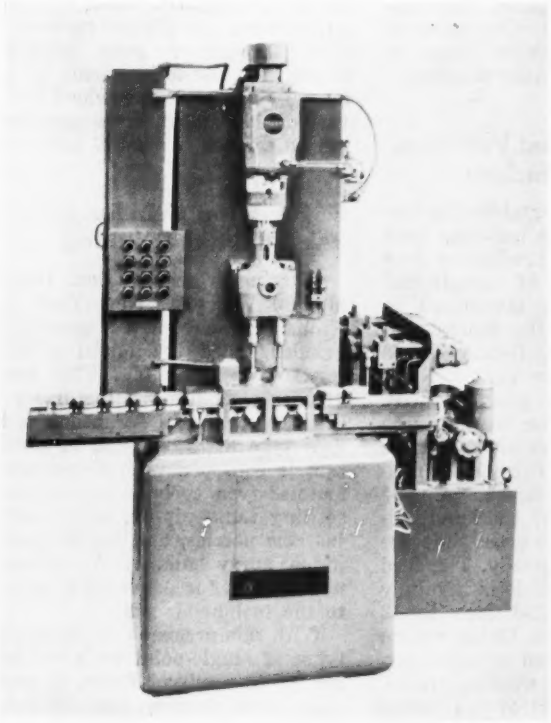
A three-station, transfer type, piston-milling machine has been placed on the market by Turner Brothers, Inc., Dept. M, 2625 Hilton Road, Ferndale, Mich. This fully automatic special-purpose machine, designed to spot-mill two center bosses at once, flush with the top finish surface of the piston, will produce 1400 workpieces per hour.

The front view of the new machine shows the two-spindle milling head, fixture, and feed track. By means of a hydraulic transfer mechanism, the pistons are taken from the automation system at the left and transferred, two at a time, into the machining position under the milling spindles. The pistons are automatically clamped and the milling spindles go through their cycle. When the operation has been completed, the parts are unclamped and ejected from the right-hand side of the machine. Each step of the operation is done automatically. The rear view of the machine shows a vacuum cleaner system that removes the chips after the machining operation and deposits them into a conveniently located gondola or tote tray.

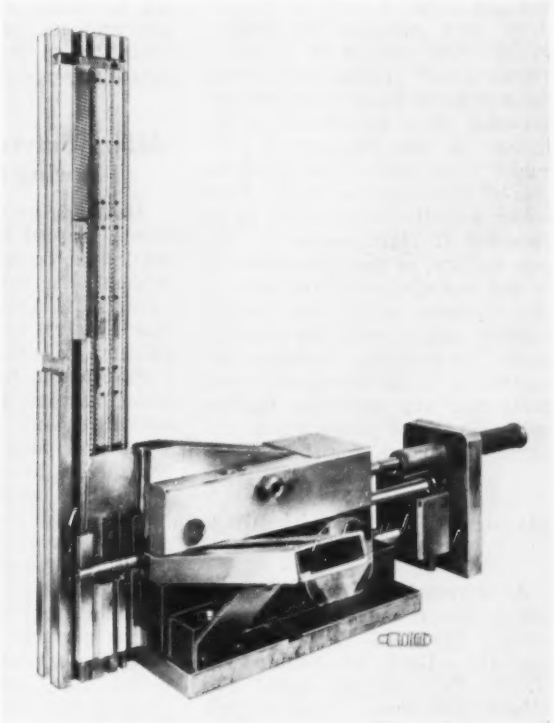
Automatic Loaders for Dual-Ram Broaching Machines

A new line of "Red Ring" automatic loaders, designed to increase the output of round parts that are externally broached on conventional dual-ram vertical broaching machines, has been brought out by the National Broach & Machine Co., Dept. M, 5600 St. Jean Ave., Detroit 13, Mich. These loaders are made in a wide variety of types to accommodate specific parts. They feature magazine feeds and compact feeding, clamping, and ejecting mechanisms. No auxiliary power source is required to actuate the loader mechanisms since the in-and-out travel of the dual-ram broaching machine tables is utilized to impart motion to the loader, feed, and clamp components.

Round parts—valve spools, universal joint needle bearing cups, and similar parts on which flats or slots can be surface broached—are easily handled on "Red Ring" loaders. Output of the loaders is limited only by the speed of the machine. An operator simply keeps the feed magazine full and

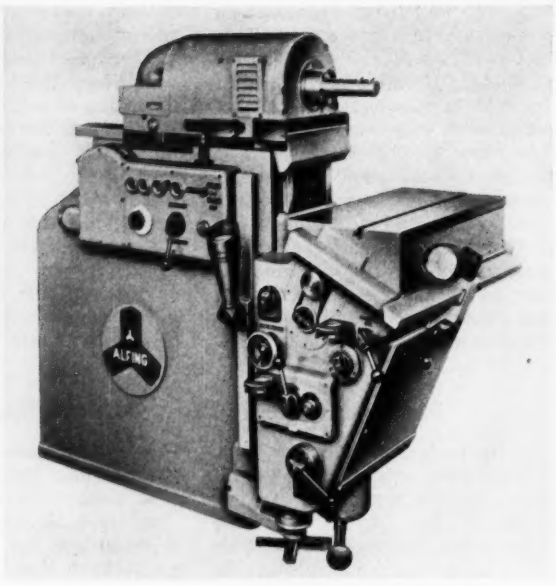


Special-purpose automatic piston-milling machine announced by Turner Brothers, Inc.



"Red Ring" automatic loader applied to dual-ram surface broaching machine

Work-positioning welding fixture brought out by Standard Portable Cord Co., Inc.



Universal precision boring machine introduced by the Morey Machinery Co., Inc.

the finished parts are automatically ejected.

Basically, the loader consists of a base supporting the magazine feed chute, feed and clamping mechanism, and unloading chute, mounted on one of the dual-ram machine tables. A plate on the machine base actuates the loader.

The one or more surface broaches used in conjunction with the automatic loading devices are mounted on a broach-holder, as shown in the illustration, the holder being keyed and bolted to one of the machine rams. This holder permits the broaches to be mounted at right angles to the ram surface, so that the parts can be fed and ejected at the side of the machine while the loaders move in and out with the machine table. The magazine feeds are designed in such a manner that parts will not enter the loaders unless they are presented in the correct position for broaching.

Magnetic Work-Positioning Welding Fixture

A universal welding fixture of unique design has been announced by the Standard Portable Cord Co., Inc., Dept. M, Jamestown, N. Y. This fixture, called the "Magic Positioner," consists primarily of three neoprene covered, Alnico V permanent magnets. Each magnet has a pull of 45 pounds. The magnets are held in a die-cast aluminum frame, as shown in the illustration, and have a full 360-degree adjustment regulated by a scale with 5-degree graduations.

When positioned, each magnet can be locked in place. This feature provides for holding parts of almost every shape or design in almost any position for welding.

Alfing Universal Precision Boring Machine

An Alfing universal boring machine, adapted for handling both small and large production jobs without the use of complicated fixtures, is being introduced in this country by the Morey Machinery Co., Inc., Dept. M, 383 Lafayette St., New York 3, N. Y. This machine is provided with optical means for setting the transverse position of work-table and the height of the knee.

Feeding movements of the headstock slide and the longitudinal traverse of the cross-slide are controlled hydraulically. The feed of the headstock slide is infinitely variable from 0.236 inch to 12 inches per minute. Quick return movements, released by hand upon completion of each working stroke, operate at a speed of 114 inches per minute. The actual hydraulic feed values with regard to the headstock slide and the cross-slide can be read accurately from a feed indicator.

The spindle speed is infinitely variable within a range of approximately 300 to 3000 R.P.M. The height setting of the work-table is obtained by means of the vertically adjusted knee. Coarse adjustments are effected mechanically through a gear driving motor, and fine adjustments by a laterally arranged handwheel. One turn of the handwheel changes the height adjustment 0.0047 inch.

Precision Grinder for Full Wet-Grinding

Thomas Prosser & Son, Dept. M, 120 Wall St., New York 5, N. Y., has announced a precision grinder called the Model APW, for full wet-grinding. This wet grinder embodies the features of the Prosser Model AP bench and floor type machines, and in addition is equipped with a separate motor-driven coolant pump, pan, settling tank, piping, valves, adjustable nozzles, and flexible neoprene spray guards. A copious flow of water is delivered directly to the tool being ground.

With this precision machine, all types of single-point tools can be ground to a mirror finish. It produces keen, durable, straight cutting edges, ground to the exact angles. High-speed steel, cast alloy, or carbide tools can be

Precision wet grinder announced by Thomas Prosser & Son

ground. One side of the grinder is equipped with a quick-acting indexing table, which can be set exactly to the desired angle. Tools can be rapidly rough-ground by hand on a vitrified wheel (or a diamond wheel if desired), to a slightly greater angle than the final finish angle, and then only a slight amount of grinding is required on the finishing wheel.

Sip Profile Projector

A profile projector designed to broaden the application of optical control in the manufacturing industries is being introduced in this country by the American Sip Corporation, Dept. M, 100 E. 42nd St., New York 17, N. Y. This Type AP-17 profile projector is of relatively small size and light weight. It serves for gaging the silhouette of a part in transmitted light (diascopic illumination) as well as for inspecting the surface of a piece by means of incident light (episcopic illumination). Both kinds of illumination are derived from one lantern only and can be combined for simultaneous examination of the contour and surface.

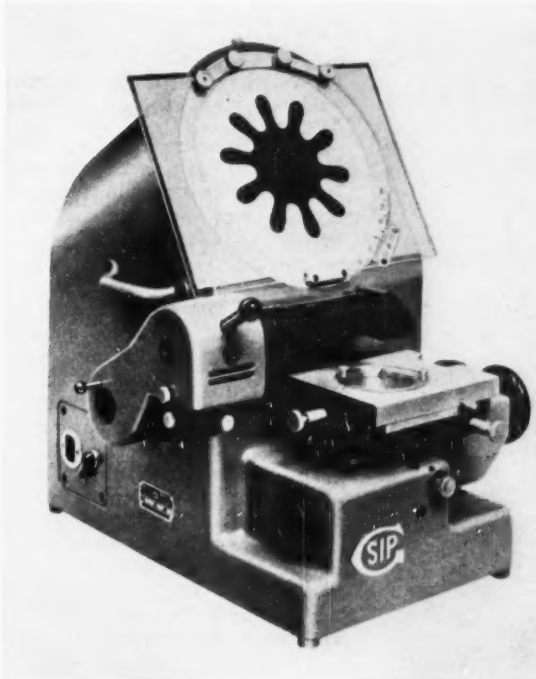
The screen is of circular form and has a diameter of 7 7/8 inches. It is rotatable and has degree graduations with a vernier scale that permits angular readings to 5 minutes of arc. A ground glass plate can be placed in front of the screen to support master drawings used for routine inspection. Three magnification ratios (10X, 20X, and 50X) are available, guaranteed to be accurate to 0.001 inch for diascopic illumination and to 0.0015 inch of their nominal value for episcopic illumination. Direct measurements can be made on the screen by means of a precision glass scale.

The object table is 5 1/2 by 4 3/4 inches and is provided with cross-slides. It carries at the center a circular glass stage 2 3/8 inches in diameter. Although primarily intended for watch factories, this projector is said to have applications in industries manufacturing large quantities of small and delicate parts, the size and the contour of which make them difficult to inspect by conventional methods.

G-E Direct-Current Rectifier Type Welder

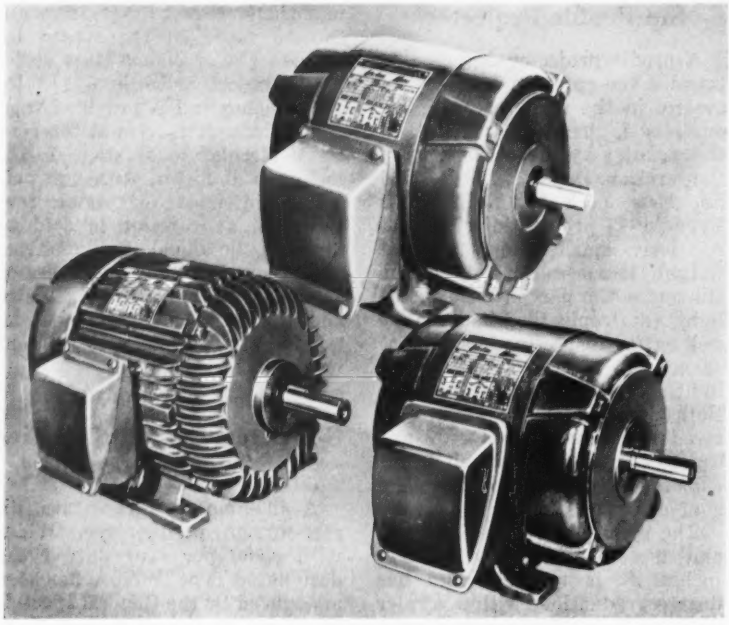
A 400-ampere, three-phase, direct-current, rectifier type welder with a 60 per cent duty cycle, designated Type WR40A, has been announced by the General Electric Co., Dept. M, Schenectady 5, N. Y. This welder can be equipped to operate on a two-phase power source and has a welding current range of 70 to 500 amperes. It can be used with a variety of electrode sizes for repair, maintenance, and construction work.

The selenium rectifier can be easily adjusted to meet current requirements.



View of Sip profile projector arranged to show silhouette projection of watch pinion

Direct-current rectifier type welder placed on the market by the General Electric Co.



Three types of "Life-Line-A" motors of improved line brought out by the Westinghouse Electric Corporation—(right) drip-proof; (left) totally-enclosed fan-cooled; and (top) totally-enclosed non-ventilated

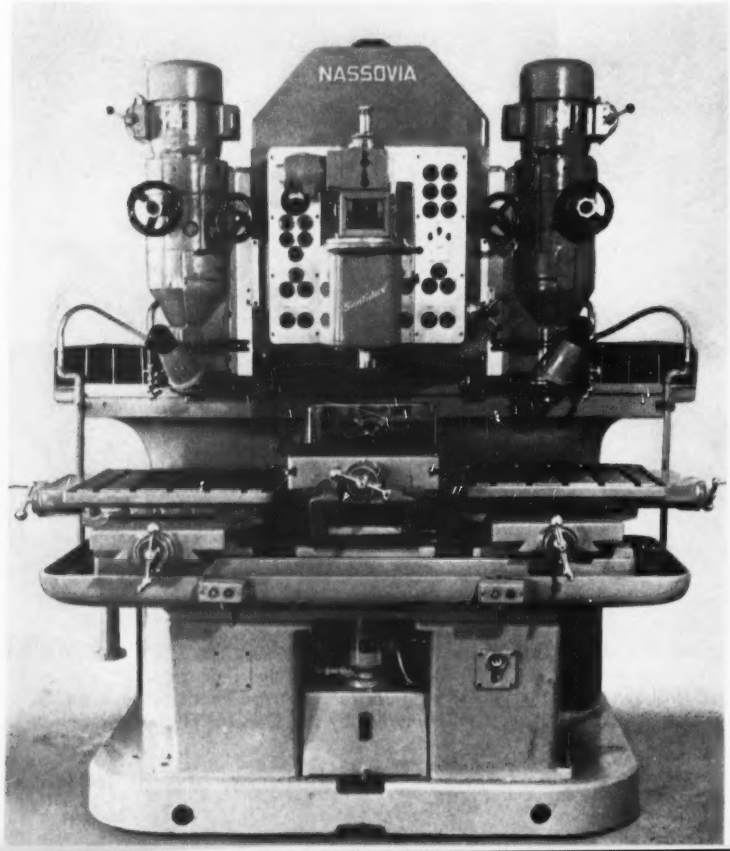
Westinghouse "Life-Line-A" Motors

A line of induction motors, designated the "Life-Line-A," has been announced by the Westinghouse Electric Corporation, Dept. M, Box 2278, Pittsburgh 30, Pa. This line includes the three types of motors shown in the illustration. All conform to the recently suggested NEMA standards which call for smaller motors without a reduction in power. Improved insulation, more efficient and better protected bearings, more effective ventilating systems, and much quieter operation are some of the outstanding advantages claimed for the new motors.

The improved mechanical parts of these motors—bearings, frame, fans, and associated parts—have been made more rugged. The bearings, for example, have a four-way seal, two on each side. The inner seal is stationary and is attached to the outer bearing race, while the outer seal rotates and is attached to the inner bearing race. The function of the rotating outer seal, or flinger, is to throw off any foreign elements and prevent them from entering the bearing.

The totally-enclosed fan-cooled motor has been improved mechanically for use in contaminated atmospheres, including a molded glass plastic blower with high corrosion resistance.

Class H (silicone) insulation gives extra protection against high temperatures and is moisture-, fume-, and chemical-resistant. The coils and rectifier stacks are cooled by a reversible 14-inch forced-draft fan designed to provide proper ventilation and prevent hot spots. The welder is operable on 220 to 440 volts. It is 35 inches wide by 26 inches long, and weighs 660 pounds.



Die-sinking and contouring machine introduced in this country by the Carl Hirschmann Co., Inc.

Die-Sinking and Contouring Machine

Carl Hirschmann Co., Inc., Dept. M, 30 Park Ave., Manhasset, N. Y., is introducing in this country a copying machine that performs both die-sinking and contouring. The machine, a Nassovia VA 11-2, has a central stylus and master table, and two work-spindles operating simultaneously. It is fully automatic, being controlled through an integral electro-hydraulic system.

Designed for the manufacture of dies, molds, and three-dimensional forming tools, the machine finds wide application in metalworking, glass, plastics, and rubber industries. It operates within an accuracy of plus or minus 0.0004 inch. Vertical walls of 90 degrees can be traced steplessly up and down. Spindle speed ranges

from 150 to 2900 R.P.M., and the clamping surfaces of the worktables are 59 by 24 inches.

Sperry "Reflectogage" for Measuring Thickness of Steel Sheets

A portable, ultrasonic instrument for measuring the thickness of steel sheets where only one surface is exposed or available, and for checking the continuity of bonds has just been announced by Sperry Products, Inc., Dept. M, Danbury, Conn. Another application of the "Reflectogage," as it is known, is testing raw stock for laminar defects. The instrument uses high accelerating voltages and a slow sweep speed. Visual indications of steel thickness from 0.014 to 0.400 inch are given on a flat-face, no-parallax cathode ray tube with directly adjacent calibration tape. The tape is made proportional to the screen size so as to give maximum reading space in any one of the six available testing ranges.

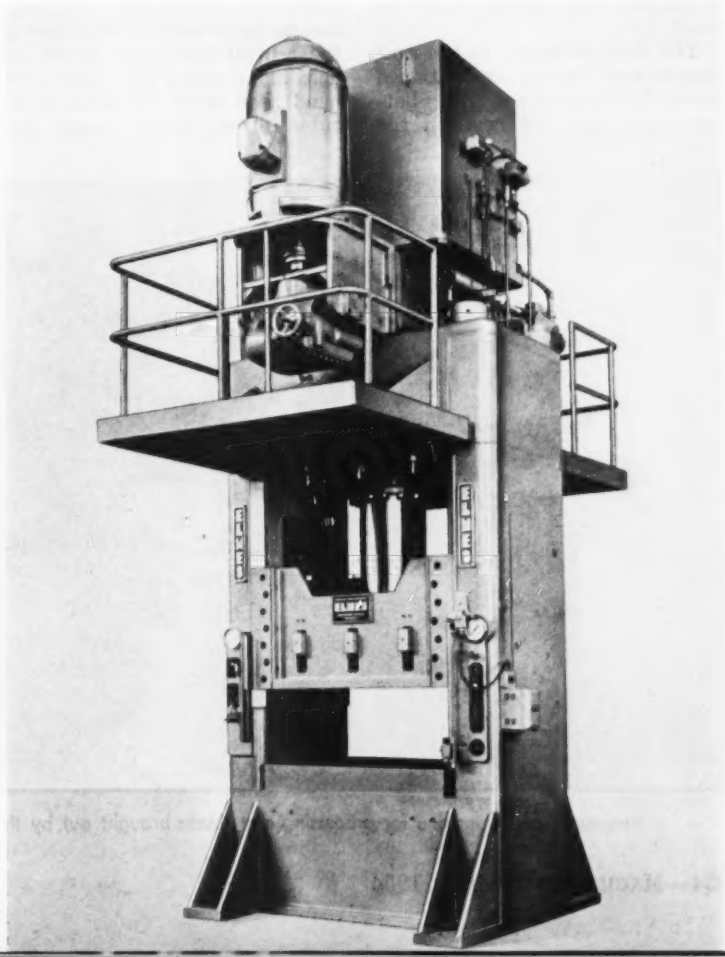
Tolerance markers appear as a downward square step on the screen base line.

"Reflectogage" for measuring thickness of steel sheet where only one side of the sheet is available

Elmes Hydraulic Single-Action Metal-Drawing and Forming Press

A 450-ton single-action hydraulic metal-drawing and forming press of "pipeless" construction has been built by the American Steel Foundries, Elmes Engineering Division, 1150-J Tennessee Ave., Cincinnati 29, Ohio. The main hydraulic circuit of this press has no piping, all high-pressure hydraulic fluid being conducted through short, direct passages drilled in the structural parts. Two reversible pumps provide an advance speed of 550 inches per minute, pressing speed of 126 inches per minute, and return speed of 550 inches per minute. The press is push-button controlled and arranged for semi-automatic, full automatic, and jog operation. In addition, a manual metering-down valve permits dropping the slide slowly and accurately when making die set-ups.

The up-stop, slow-down, and reversal positions of the press are controlled by limit switches mounted on long screws that can be raised or lowered to any desired position by turning the position control crank. A safety device consisting of a photo-electric "curtain" covering the vertical entry plane and interlocked with



Elmes high-speed hydraulic press with photo-electric safety device

the press "close" electrical circuit protects the operator's hands. If the operator passes his hands through the photo-electric curtain, as the dies are about to close, the press ram will automatically reverse and stop at the full open position.

A high-temperature cut-out switch prevents the oil from being overheated. This unit consists of a manually pre-set thermostat with two sets of contacts, one normally closed and the other open. When the maximum temperature has been reached, the normally closed contacts open to break the control circuit, and at the same time the normally open contacts close, lighting up the red light on the push-button station to indicate excessive oil temperature.

Snyder Automatic Cycle Four-Station Machine for Processing Large Drum

An automatic cycle, four-station, line-indexing type machine for processing a large, shaped drum of cast aluminum alloy is announced by the Snyder Tool & Engineering Co., Dept. M, 3400 E. Lafayette, Detroit 7, Mich. The cast drum is an aircraft part, 32 inches in diameter and 12 inches deep, consisting of an outer drum and a central boss joined by four ribs. Processing consists of drilling a total of 140 holes, and reaming and chamfering as required. The entire work cycle is automatic and the machine is interlocked electrically to prevent misfunctioning. Production is at the rate of six pieces an hour.

The work is loaded at the first station and located and clamped manually. When the starting button is pressed, the head on the left-hand side of the machine at the first station advances and drills eighteen holes in the central boss flange, which is 3/8-inch thick. At the second station, the head drills forty holes in the flange of the outer drum (which also is 3/8 inch thick), reams four holes and countersinks eleven holes in the central boss. Simultaneously, the head on the right-hand side of the machine drills forty holes in the outer drum flange and twelve holes in the central boss, and countersinks one hole in an offset rib.

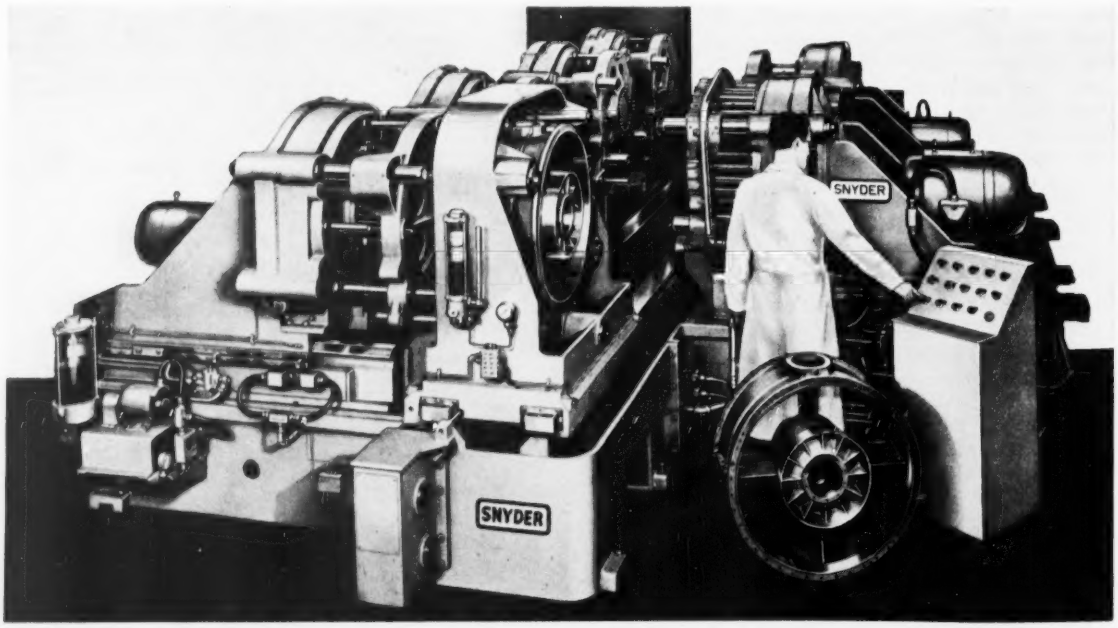
At the third station, the head on the left-hand side countersinks nine holes in the outer drum flange, drills twenty-two holes in the central boss, and reams one hole in an offset rib. The right-hand head drills six holes in the outer drum flange, reams two holes, countersinks ten holes in the central boss, and reams one hole in an offset rib. At the fourth station, the head on the left reams five holes in the outer drum flange, reams one hole, and countersinks twenty holes in the central boss. The right-hand, head line-reams one hole in an offset rib.

An unusual feature of this machine is the chain index mechanism driven by a fluid motor, by means of which the fixture is moved through the four work stations for the machining operations and returned to the first station. High-speed steel tools are used at 250 surface feet per minute with various feed speeds. A total of 80 H.P. is used in the spindle drive motors and a total of 10 H.P. in the hydraulic drives. Lubrication is from a motorized automatic system.

U. S. Burke Milling Machine

A vertical milling machine brought out by the U.S. Burke Machine Tool Division, Cincinnati Mfg. Corporation, Dept. M, Cincinnati 27, Ohio, is here shown. This machine is a companion to the Burke "U.S. No. 1" horizontal miller.

The vertical machine offers improved facilities for vertical boring, end-milling, dovetailing, and similar operations. The table pro-



Automatic cycle machine for processing cast drums brought out by the Snyder Tool & Engineering Co.

Vertical milling machine built by U. S. Burke Machine Tool Division, Cincinnati Mfg. Corporation

vides a working surface 9 1/2 by 36 inches and the quill has a travel of 5 1/2 inches. The head is balanced by mounting the motor behind the supporting column. The guard and motor can be easily raised to simplify changing the belt to any pulley position. The machine weighs approximately 1600 pounds and requires a floor space of 60 by 75 inches.

Sheffield Gaging and Inspection Equipment

A new method of air gaging, using the equipment shown in Fig. 1, has been developed by the Sheffield Corporation, Dept. M, Dayton 1, Ohio. The gaging equipment is used in determining the amount of assembly clearance in the dovetail slots of a jet-engine compressor vane support. It consists of a column type "Precisionaire" and a gaging spindle simulating the dovetail root form that fits into the slot in the vane.

The spindle contains a single "Balljet" and a pressure pad arrangement. As the gaging spindle is inserted in the dovetail slot, the pressure pads force it against the angular faces and the Balljet registers along the bottom, determining the rate of air escapement.

The amount of assembly clearance in the dovetail slot is indicated by the position of the float in the glass column, and, as the gage has an amplification of 2000 to 1, a variation as little as 0.0001 inch is amplified to 0.25 inch on the Precisionaire scale.

The Sheffield gaging machine shown in Fig. 2 automatically inspects seven dimensions of a piston and segregates acceptable and rejects unacceptable pistons at a rate of 2200 per hour. Dimensions checked include diameters of the top land, top groove, second groove, and oil groove; and widths of the top, second, and oil groove.

The gage is simple to operate. After the piston is placed in the loading position, it is progressively moved into the two gaging stations by an air-operated push-bar. At the first station, widths of the ring grooves are gaged by means of GO and NOT GO rolls. If the grooves are out of tolerance, a memory circuit is set up and the piston is rejected at the next station. Acceptable pistons next travel through a guard of carbide fingers which will stop the forward progress of the push-bar if a piston has no ring grooves or a ring groove is inaccurately located. When this occurs, the rejected piston is removed by hand and the machine restarted.

The second station gages the diameters of the three ring grooves and the top land with Sheffield "Electrichek" gage heads. The gage heads are mounted on four pairs of pivoted arms. Carbide-tipped points contact the part, causing the arms to spread and actuate gage heads that indicate whether or not the dimensions are within the specified tolerance. Rejected pistons drop through the trap door, while acceptable pistons leave the gage by a chute at rear of machine.

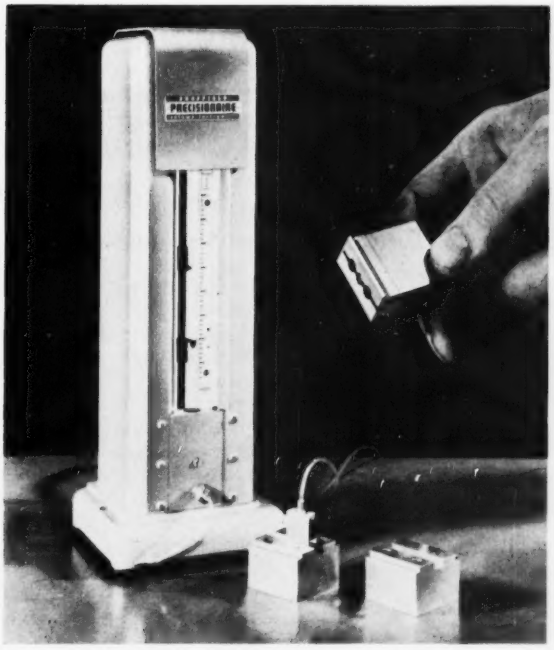
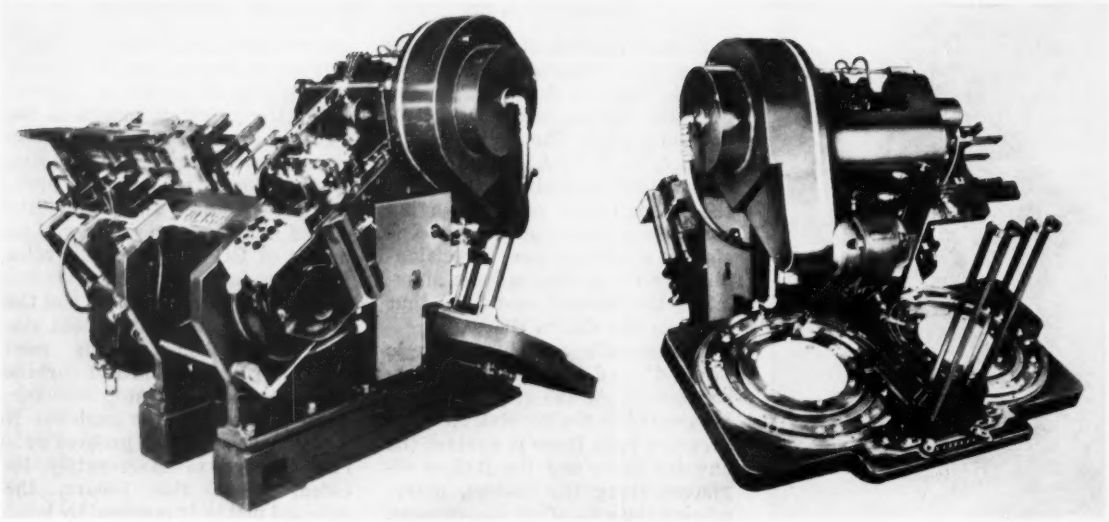


Fig. 1. Sheffield "Precisionaire" and "Balljet" equipment for gaging slots in jet-engine part

Fig. 2. Gaging machine for automatic inspection of pistons developed by Sheffield Corporation



(Left) Bliss high-speed strip feed press. (Right) Automatic double-end curler used in conjunction with the press shown

Bliss High-Speed Strip Feed Press and Double-End Curler

An automatic strip feed press, developed by the E. W. Bliss Co., Dept. M, Canton, Ohio, to produce sanitary can ends and closures, has been undergoing test runs at the company's plant in Hastings, Mich., where it has operated satisfactorily at speeds above 300 strokes per minute. The following features have been included in the design of this No. 1831 press to facilitate continuous operation at high speed and to minimize vibration and maintenance: an electrically controlled combination disc friction clutch and brake; balanced crankshaft; and a feed-bar with adjustable fingers that is driven positively by a crank instead of a lever.

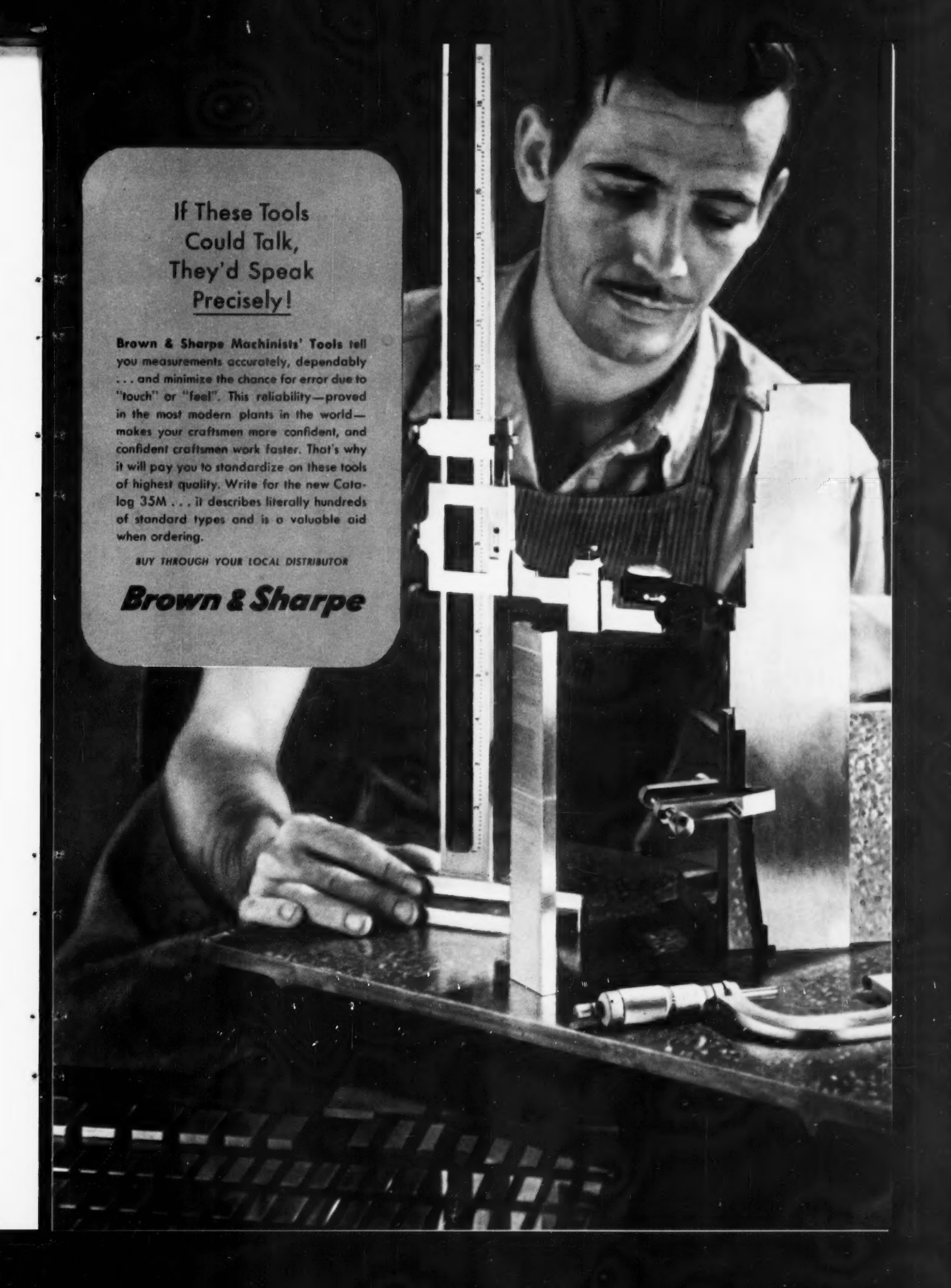
Another feature of this press is the elimination of the idle stroke between strips. The bolster area has been increased to 17 inches front to back by 16 inches left to right. The press timing has also been arranged so that the slide stops automatically at the top of its stroke.

In conjunction with the strip feed press, the E. W. Bliss Co. has announced a No. 20 automatic double-end curler for curling can ends. This new unit, shown at the right in the illustration, has very heavy bearings and is equipped with an individual motor drive. It is adjustable to accommodate ends for cans in sizes from 202 to 404.

Surface grinder that is equipped with Portman optical form grinder projector-comparator

Optical Form Grinder Projector-Comparator

The optical form grinder projector-comparator shown on a standard surface grinder in the illustration has just been announced by the Portman Instrument Co., Inc., Dept. M, Town Dock Road, New Rochelle, N. Y. This projector-comparator, known as Model OFG-200, is a dual-purpose optical instrument, being designed both as an optical form grinder projector and as a conventional universal type optical comparator. The instrument may be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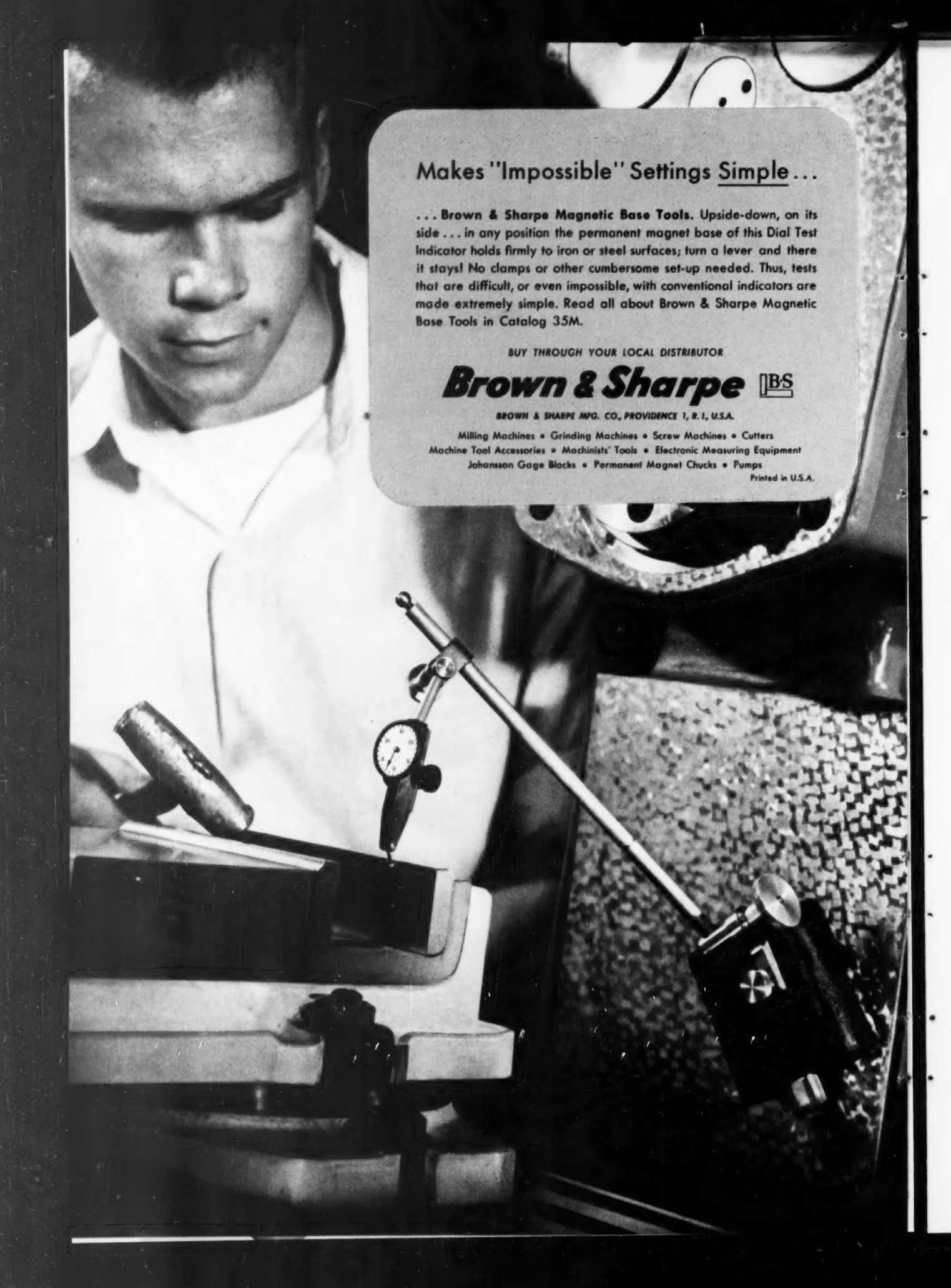
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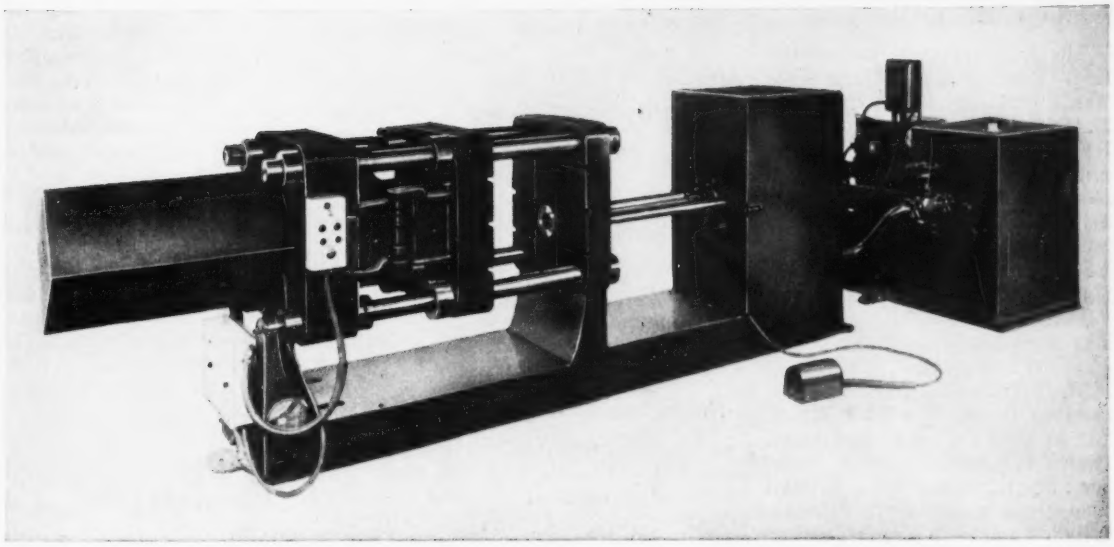


Heavy-duty cold chamber die-casting machine announced by the Harvill Mfg. Co.

used on most standard precision surface grinders of either the 6-by 18- or 8-by 24-inch size.

Operation as an optical form grinder projector is extremely simple. Conventional grinder controls are used to develop most shapes and forms simply by following the enlarged projection of the drawing on the screen. The projector-comparator can be used as a bench type optical comparator.

The instrument has the newly developed long focal length Portman "Multi-Phase" optical system so that it can be used on all types of work. Lenses provide eight magnifications ranging from 10X to 100X. The new high-powered light source has a variable volume control, is blower-cooled, and provides completely uniform illumination over the entire 16-inch diameter screen. The housing for the light is equipped with a triple-station color filter turret to provide proper screen contrast.

Harvill Die-Casting Machine

Introduction of a new heavy-duty cold chamber type die-casting machine has been announced by the Harvill Mfg. Co., Dept. M, Corona, Calif. This Model HD-303 machine is particularly adapted to casting aluminum alloys at high speed from either single or multiple cavity dies. Magnesium and brass are also readily cast with the machine. Zinc, lead, and tin can be cast after conversion to hot chamber operation.

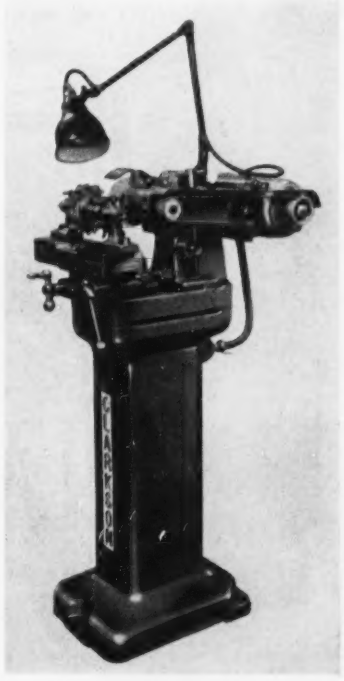
A high-pressure oil-hydraulic system supplies the operating and injection power for the unit, with pressure up to 11,800 pounds per square inch on the molten metal as it solidifies in the die cavity. Provision is made for fast, easy die changing. The dies are fully closed and locked under a pressure of 300 tons.

The tie-bars are pre-stressed when dies are closed to withstand metal injection pressures up to 10,000 pounds per square inch over a die projected area of 75 square inches. All piping and fittings on the hydraulic system power unit are of high-pressure steel and welded at the joints with flange connections to the valve and pump. The 15-H.P., 220-volt, three-phase motor has push-button control.

Clarkson Cutter Grinder

A cutter grinder designed for the volume production of cutting tools is being manufactured by Clarkson, Inc., Dept. M, 320 Ontario St., Toledo, Ohio. Cutters can be set and completely sharpened on this machine in from fifteen to twenty-five minutes. The grinder is driven by a 1/2-H.P. motor and is always operated from the front, the work being so placed that it can be easily viewed by the operator. A lamp, adjustable at any angle, provides concentrated illumination of the work.

End mills, as small as 1/8 inch in diameter, and large side and face cutters can be easily sharpened. Equipment can be supplied to permit sharpening all straight and Morse taper shank cutters, and all sizes of side and face cutters up to 6 inches in diameter with 1- and 1 1/4-inch diameter holes. The machine is also adapted for sharpening slot drills, reamers, Woodruff cutters, T-slot cutters, cylindrical cutters, face mills, angle cutters, and hollow mills.

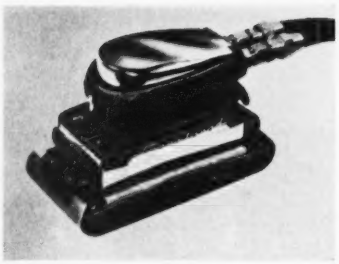


Cutter grinder designed by Clarkson, Inc.

Sajo Milling Machine

The Austin Industrial Corporation, Dept. M, 76 Mamaroneck Ave., Box 430, White Plains, N. Y., is introducing in this country a Sajo Model 53 all-geared milling machine, latest addition to the line of milling machines manufactured by A. B. Sandens Mekaniska, Varnamo, Sweden. This milling machine is comparable in capacity to a No. 2 light-duty horizontal milling machine. The table has a working surface 41 11/32 by 9 1/4 inches.

The spindle has sixteen speeds ranging from 39 to 1500 R.P.M. (31 to 1200 R.P.M. optional) and twelve independent power feeds, for longitudinal, vertical, and transverse movements. Features include an anti-friction, all-geared transmission; spindle speed and table feed selectors on direct-reading dials; a spindle start-stop-brake lever adjustable for easy accessibility from operating position; and a safety clutch for the protection of the feed mechanism. These milling machines are available in both plain and universal types, with standard attachments and accessories.



Air sander announced by the Pneumatic Division of the Sundstrand Tool Machine Co.

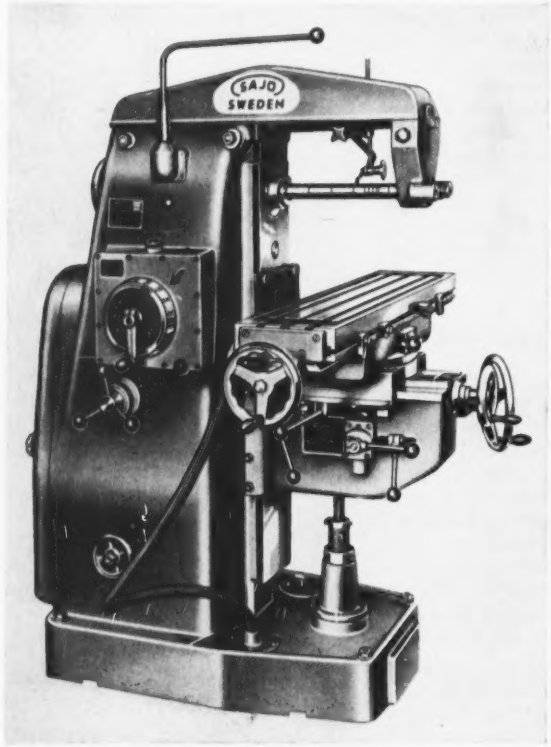
Sundstrand Orbital Sander

The development of a new type air-operated sander for the fast removal of material has been announced by the Pneumatic Division of the Sundstrand Machine Tool Co., Dept M, 2531 Eleventh St., Rockford, Ill. This sander operates at speeds up to 6000 cycles per minute. It is said to be ideal for rough-sanding and preliminary operations, providing a quick, economical means for preparing surfaces for final finishing operations. A built-in water unit facilitates wet sanding. Material can be removed rapidly and economically from metal, wood, or plastic parts with this sander.

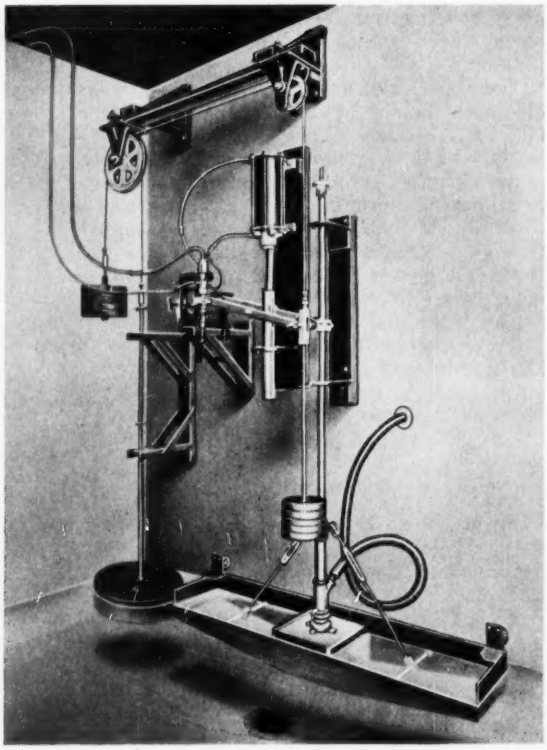
The small, compact unit weighs 4 1/2 pounds and fits into the palm of the hand. It is precision-constructed and counterbalanced to minimize vibration and reduce fatigue. Air consumption is low, being only 5 1/2 to 7 cubic feet per minute. A unique pad control eliminates side sway, making it possible for the sander to be used next to edges, moldings, and in tight corners without damaging the work. A slight downward pressure on a palm-operated lever on top of the unit controls both the air and water supply.

Simplex Skimmer for Reclaiming Oil

A new device for reclaiming oil after it has served its original purpose is now available from the Simplex Valve & Meter Co., Dept. M, 68th and Upland St., Philadelphia 42, Pa. This "Oil Skimmer" operates from the liquid level in a chamber through which the waste is flowing. It is claimed that large quantities of valuable oil, that otherwise would be lost, can be saved with the device.

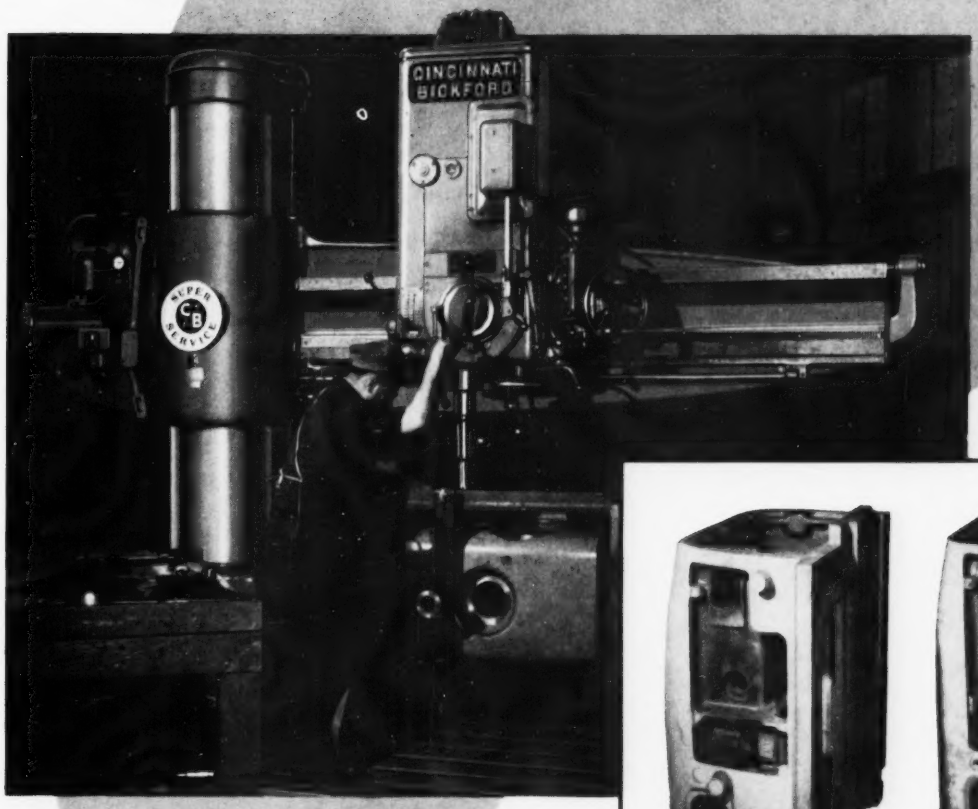


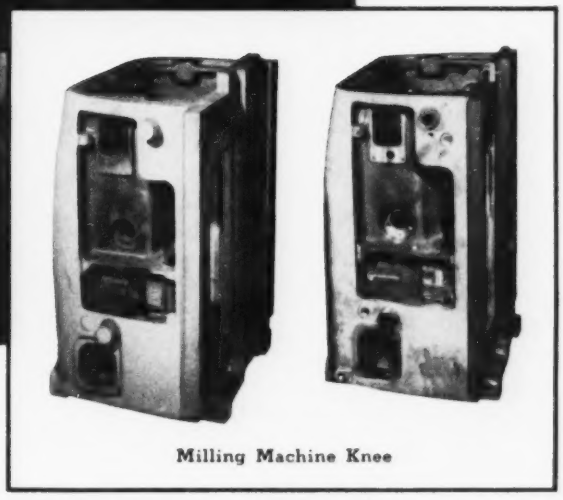
All-geared milling machine introduced in this country by the Austin Industrial Corporation



"Oil Skimmer," a device for reclaiming oil, brought out by the Simplex Valve & Meter Co.

Bickford accuracy





Milling Machine Knee

Photos courtesy of the George Gorton Machine Company, Racine, Michigan

. . . HELPS BUILD ACCURATE MACHINE TOOLS

To .0005" accuracy, this performance in drilling, reaming and boring 100 holes from ½" to 2½" diameter to 3" deep, to this tolerance, is typical of Cincinnati Super Service Radial Drills.

Here at the George Gorton Machine Company, manufacturers of machine tools, where accuracy is necessary, ten Cincinnati Bickford machines are in use.

Write for Catalog R-29.

CINCINNATI BICKFORD

SUPER SERVICE RADIAL AND UPRIGHT DRILLING MACHINES

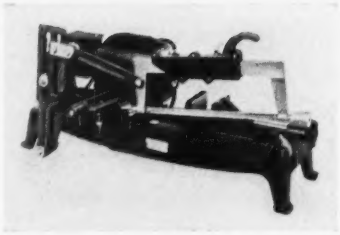
THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

The Oil Skimmer consists essentially of four groups of equipment—a movable trough with rollers and supporting guide rod; a hydraulic cylinder with a compound lever attachment; a four-way hydraulic valve with a hydraulic power pack; and a counterweighted float and cable assembly. These groups are mounted on the wall of a chamber with the float and the trough operating in a vertical plane.

Dymond Portable Power Hacksaw

La-Roy Industries, Inc., Dept. M, 810 Fowler St., Howell, Mich., has announced a Dymond portable power hacksaw for cutting machine steel, tool steel, aluminum, brass, bronze and non-metallic materials. This hacksaw has a mechanical motion that provides cutting action on the forward stroke of the blade, and automatic lift and release of pressure on the return stroke.



Dymond portable hacksaw

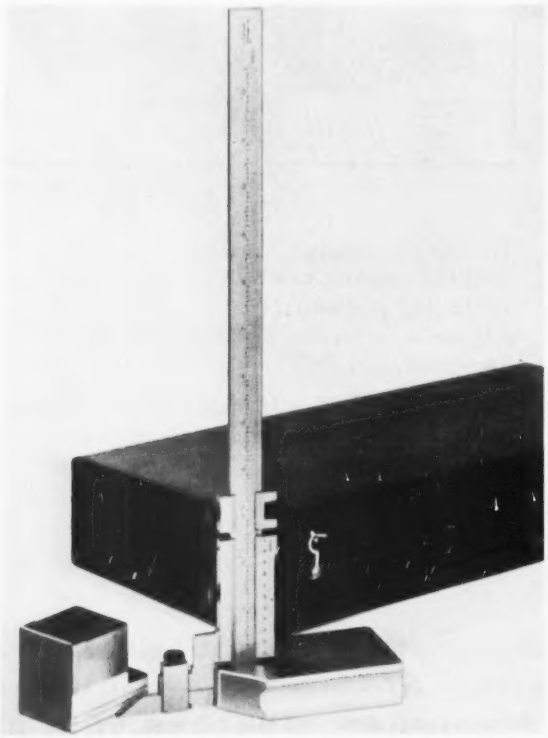
The saw has an automatic stop that permits the operator to set it to the desired cut and attend to other work during the cutting operation. It has a quick-action vise that holds stock up to 2 3/4 inches square, and is easily adjusted to take 15-, 30-, or 45-degree cuts on channels, pipe, and solid bar stock.

A vernier 2.450 inches long, divided into fifty lines, extends over forty-nine graduations of 0.050 inch each on the main scale. This makes the spaces between the division lines of the vernier and main scale large enough to permit reading measurements of 0.001 inch with the naked eye. An open slide permits viewing the entire scale and facilitates faster reading. Stock sizes have measuring capacities of 10, 20, and 40 inches.

The universal test indicator, called the "Puppitast," can readily be attached for reading in 0.0001 or 0.005 inch. This indicator is adapted for general tool-room and machine shop use and for high-production inspection. Movement of the indicator hand is reversible by means of a lever. The contact points move in a 180-degree arc and the entire indicator swivels in all directions around a pivot in the shank. Split bushings are included for clamping to machines.

Vernier Height Gage and Universal Test Indicator

The George Scherr Co., Inc., Dept. M, 200 Lafayette St., New York 12, N. Y., is placing on the market a vernier height gage and a universal dial indicator. The height gage, here illustrated, has a base that is slotted to allow the short solid jaw with a straight scribing point to reach down to the surface plate.



Height gage introduced by the George Scherr Co., Inc.

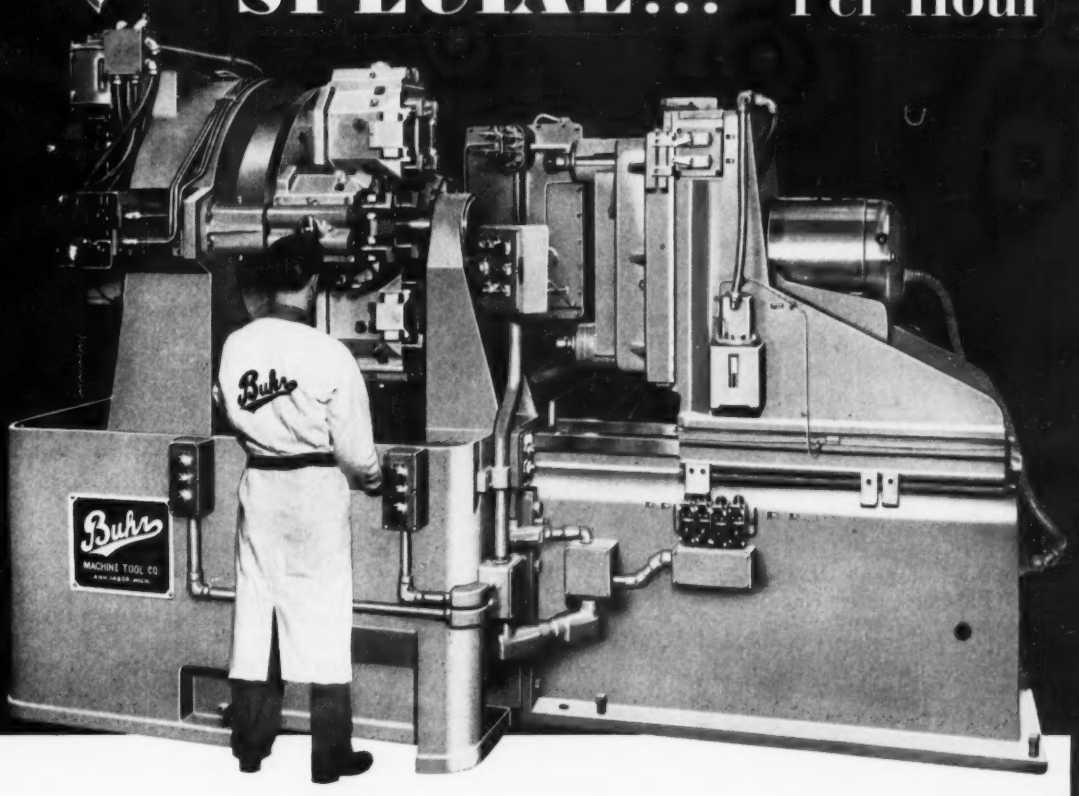
Pressure Blast "Roto-Matic"

An automatic wet-blasting machine known as the pressure blast "Roto-Matic" has been added to the line of manually-operated blast units made by the Cro-Plate

Cro-Plate "Roto-Matic" wet-blasting machine

Buhr

SPECIAL... Mills and taps 510 Oil Seal Retainers Per Hour



Fixture is arranged with hydraulically operated automatic clamping and automatic index.

Operation: Loading two parts. Station 1 — Load and Clamp.
Station 2 — Tap (2) 5/16-18 Holes and mill two Slots.
Station 3 — Idle.
Station 4 — Tap (2) 5/16-18 Holes and mill two Slots.

As with all Buhr Specials, fixtures are completely interchangeable, hydraulic and electrical installations to J.I.C. Standards, tool steel laminated, hardened and ground ways. Automatic lubrication throughout Machine.

BUHR MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

Buhr
MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

Co., Inc., Dept. M, 747 Windsor St., Hartford 5, Conn. This machine is designed to eliminate the necessity for grinding, wire brushing, and chemical cleaning of small metal castings, forgings, machined items, stampings, extrusions, and various plastic, and ceramic components.

The operator seated at the front of the unit simply loads and unloads work-pieces from the rotating table, which is fitted with work-holding fixtures. The cabinet interior is divided into three chambers that are accessible through inspection doors. In the first chamber the work is either entirely or partly finished by fixed position blasting guns. The second, or rinse, chamber rinses the abrasive slurry from the work, and the third, or air-dry, chamber dries the work. A simple, readily accessible panel contains all necessary controls for operating the machine. Included is a variable-speed table drive regulator that governs the length of time the work is to be kept in the blasting chamber.

"Diametrick" Gage for Internal Checking

A dial indicator measuring instrument called the "Diametrick," designed for measuring inside diameters, has recently been introduced by the Mutual Engineering Service, Dept. M, 402 Court St., Saginaw, Mich. This instrument is adapted for checking O-ring and snap-ring grooves and is also applicable for measuring other inside diameters. It will check holes from 1.375 to 3.625 inches in diameter and will expand to measure grooves as deep as 1/4 inch.

"Diametrick" dial gage used to check diameters of internal grooves and bores

In using this instrument, it is held with the lower gaging arm resting firmly in the work, permitting rocking of the upper arm in all directions. It can be used to advantage as a caliper in the toolroom and experimental department.

H-P-M Line of Improved Hydraulic Cylinders

The Hydraulic Power Division of the Hydraulic Press Mfg. Co., Dept. M, Mount Gilead, Ohio, has announced an extensive line of hydraulic cylinders consisting of more than 800 basic models. A wide range of mountings designed for interchangeability of equipment is available—including foot, side lug, center-line, clevis, base, flange, rabbet, trunnion, and subplate designs. Adjustable stroke cylinders are also available with foot or center-line mountings.

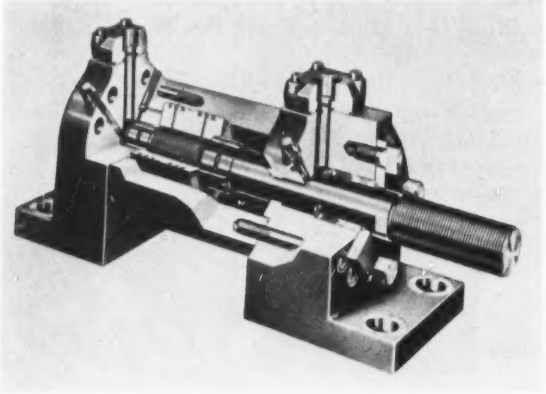
Features of the new cylinder line include heavy-duty construction with substantial safety factors and spring-loaded piston-rod packings for positive sealing. End covers are solid steel members machined for accurate alignment of piston and rod.

Cylinders are available with single- or double-end piston-rods, with or without cushions, and with many combinations of mountings. In addition to the standard ground and polished steel piston-rods, chromium-plated, hardened, or hardened and chromium-plated piston-rods are also available.

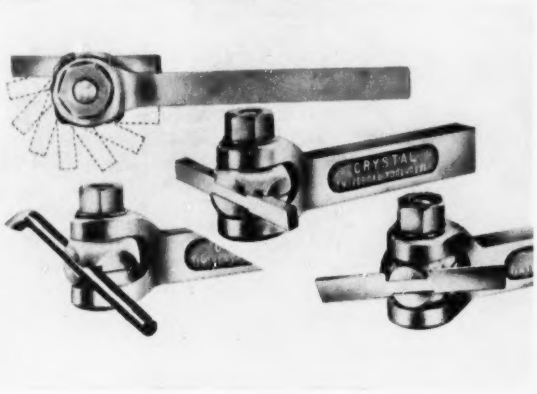
Bore sizes in the standard cylinder line range from 1 1/2 to 12 inches. Cylinders of larger size and of unusual design, including single-acting, collapsible or telescoping types, and cylinders for water service, can be developed to meet special requirements. The standard line includes cylinders designed for 150 pounds per square inch air service up to 3000 pounds per square inch oil-hydraulic service.

"Crystal" Universal Tool-Holder

A tool-holder that permits the tool bit to be tilted up or down and pivoted around to almost any cutting position has been placed on the market by the Seaboard Steel Co. of America, Inc., Dept. M, 1775 Broadway, New York 19, N. Y. The tool bit is firmly held in this "Crystal" universal tool-holder by an ingenious arrangement in which a split swivel ball is clamped in any desired working position by a single bolt. The tool-holder takes 3/8-inch square or round tool bits.



Cut-away view showing construction of H-P-M 3000 pounds per square inch oil-hydraulic cylinder



"Crystal" universal tool-holder has been brought out by the Seaboard Steel Co. of America

(*This section continued on page* 250)

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ENGINEERING EXCELLENCE

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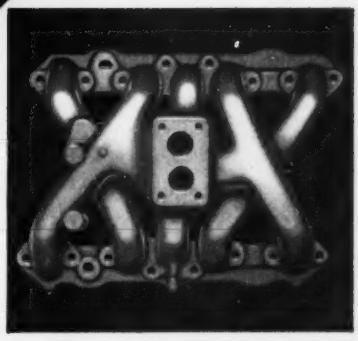
like this short Transfer with Overhead Return Conveyor— created to do a tough job in minimum floor area!



Part and Production: Intake Manifold for a new leading V-8 Engine. 180 pieces per hour at 100% efficiency.

Type of Specialized Production Equipment: 6-Station Automatic In-Line Transfer-Type Drilling-and-Tapping Machine with Automatic Overhead Pallet Return.

Tooling: Single-Place Pallet-Type Fixture with Manual Clamping. Anti-friction Drill and Individual Lead-Screw Tapping Heads.

BEFORE this PEERLESS, Plant Engineers were told that it was impossible to make a Transfer Machine which could be installed in such a small floor area.

NOW this PEERLESS, with specially-designed Overhead Pallet-Return Mechanism, is doing the job—setting a new high in maximum use of floor space!

Built to process all angular and bastard holes on Intake Manifolds, this PEERLESS was engineered for great flexibility—

Flexibility to take care of engineering changes if motor parts are altered.

Isn't this the kind of Engineering Excellence you want for your Specialized Production Equipment?

See other examples of PEERLESS Engineering Excellence that does the Never-Before, NOW!

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Chicago Pneumatic's new CP-3008 is a really quiet air-powered screwdriver. Its Super-sonic exhaust changes sound waves to a frequency which approaches the limit of human hearing. Of rugged, all-steel construction, it weighs only 1 lb. 14 oz. . . . has a side outlet exhaust deflector that rotates and locks in any position for directional exhaust. Has built-in speed control for precision driving on delicate work. Torque can be easily adjusted without special tools. Handles #4, #6 and #8 screws . . . will handle some #2's and #10's. Write for Bulletin SP-3096. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

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For more information on products advertised, use Inquiry Card, page 247

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Card below for further information
On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

PRE-FINISHED METALS—American Nickeloid Co., Peru, Ill. 22-page catalogue on pre-finished Nickeloid metals, giving fabrication techniques, uses, and properties. Can be obtained on letterhead request direct to the above address.

STEELS—Firth Sterling, Inc., Pittsburgh, Pa. Catalogue Section 20-250, descriptive of Firth Sterling Best, a water-hardening carbon tool steel; Section 10-030 on Firth Sterling FS 2-5, a medium tungsten, vanadium-cobalt high-speed steel; Section 20-260 on Firth Sterling Extra, a water-hardening carbon tool steel; and Section 20-280 on Sterling V, a water-hardening carbon-vanadium tool steel. Characteristics, typical applications, forging, general heat-treatment, annealing, hardening, and tempering data are given. 1

FORGED SHAPES—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Handbook outlining hammered forgings, composite die sections, and cast-to-shape tool steels produced by the Forging and Casting Division of the corporation. Properties and treatments, as well as other useful reference material, are included. 2

CYLINDRICAL GRINDING—Landis Tool Co., Waynesboro, Pa. "How to Do It" handbook, 36 pages, offering useful information to reduce cylindrical grinding costs, improve quality, and train operators. It contains charts on grinding wheel speeds and gradings, and gives suggestions on correcting common grinding troubles. 3

SILICONES—Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, New York City. Booklet F-8271A, describing three new Linde silicones specially designed as shell mold release agents—LE-46 silicone parting emulsion, LS-46 silicone parting solution, and L-46 modified silicone stock. 4

PLAIN MILLING MACHINE—Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin describing the Brown & Sharpe No. 000 plain milling machine for the economical production milling of small pieces, such as parts for firearms, radios, and business machines. The automatic milling cycle of the machine is explained. .. 5

COPPER-PLATED GEARS—Brad Foote Gear Works, Inc., Cicero, Ill. Booklet 1988, describing the company's program in the manufacture of copper-plated gears, reducers, gearmotors, assemblies, and transmissions that conform not only to industry standards but to the Brad Foote "Certified" formula. 6

CEMENTED CARBIDE PRODUCTS—Kennametal, Inc., Latrobe, Pa. Catalogue 54, containing 73 pages of descriptive information on Kennametal cemented carbide products, including an expanded line of profiling tools. Sections on technical data and varied applications are included. 7

PROBLEMS FOR RESEARCH ON MATERIALS—American Society for Testing Materials, Philadelphia, Pa. 24-page booklet entitled "Some Unsolved Problems," consisting of a compilation of current problems as a suggested basis for needed research work in the study of properties of materials. 8

MOTOR STARTERS AND PUSH-BUTTONS—General Electric Co., Schenectady, N. Y. Bulletin GEA-6061, containing selection information on alternating-current, magnetic motor starters, combination starters, push-button stations, manual motor starters, and magnetic reversing controllers. 9

PROCESS CONTROL INSTRUMENTS—Wheelco Instrument Division, Barber-Colman Co., Rockford, Ill. Bulletin F-5633-1, listing typical instruments manufactured by the Division, such as recorders, controllers, indicators, combustion safeguards, and control accessories. 10

KNUCKLE JOINT PRESSES—Cleveland Punch & Shear Works Co., Cleveland, Ohio. Catalog K2, describing and illustrating Cleveland knuckle joint presses, recommended for use in the manufacture of products requiring a short but extremely powerful squeeze on the metal. 11

CARBIDE BURS—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 564 on Kellerflex carbide burs used in powered hand tools and stationary machines for cutting hardened steel or soft materials. Standard shapes and sizes are shown. 12

METAL-WORKING FACILITIES—Twigg Industries, Inc., Brazil, Ind. Colorful 20-page booklet describing the engineering and production facilities for the fabrication and machining of high capacity metals into lightweight precision parts. Tube bending, spinning, heat-treating, and stress relieving are featured. Special section devoted to titanium. 13

DIE-CASTING MACHINES—Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin describing the two smallest die-casting machines in the Cleveland line—the Model 50 for aluminum, brass, or magnesium alloys; and the Model 100 for zinc, tin, or lead. 14

CARBIDE TWIST DRILLS—Super Tool Co., Detroit, Mich. Circular 541, on the company's line of metal-cutting carbide-tipped and solid carbide twist drills, core drills, and super-hard drills, giving complete size and net price information. 15

SPEED REDUCERS—Eberhardt-Denver Co., Denver, Colo. Catalogue 1006, 48 pages, showing the company's line of worm-gear speed reducers and giving engineering information regarding selection of reducers, horsepower and torque calculations. 16

ALLEGHENY METAL—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Booklet describing the uses of Allegheny Metal stainless steel in the pulp and paper industry. A section is included on the technology of Allegheny stainless steel. 17

LUBRICATION—Bijur Lubricating Corporation, Rochelle Park, N. J. Bulletin NB-14, presenting applications of Bijur lubricating systems to a turret lathe, a hobber, a punch press, and a compressor. 18

BENCH TYPE MILLING MACHINE—Barker Engineering Co., Cleveland, Ohio. Circular BM 9-53, describing the Barker mill, which performs a variety of operations on small parts, such as milling, profiling, drilling, key-seating, and slotting. 19

CYLINDRICAL GRINDERS—Landis Tool Co., Waynesboro, Pa. 20-page booklet entitled "Job Engineered Landis Grinders—the Landis Approach to Cost Reduction." Illustrated are examples of grinders engineered to specific requirements. 20

SCREW CHECKING DEVICE—Holladay Tool Research, Portland, Ore. Leaflet descriptive of a new combination tool called the Screw-Chek'r for checking small screws with fine threads, also serving as a cutting and holding tool, and screw information chart. 21

MEEHANITE CASTINGS—Meehanite Metal Corporation, New Rochelle, N. Y. Bulletin 43, entitled "Meehanite Castings for Pressure Tightness," containing 64 illustrations of specific industrial applications of Meehanite castings. 22

OIL-TIGHT PUSH-BUTTONS—General Electric Co., Schenectady, N. Y. Booklet GEA-5779B, describing the complete G-E line of oil-tight push-buttons, indicating lights, selector switches, and accessories. 23

KNUCKLE PRESSES—Verson Allsteel Press Co., Chicago, Ill. Catalogue K-53, giving design details and specifications of Verson knuckle presses for squeezing operations such as coining, embossing, and sizing. 24

INCO WIRE, ROD, AND STRIP—Alloy Metal Wire Co., Prospect Park, Pa. 37-page handbook summarizing physical and mechanical properties of Inco nickel alloys in wire, rod, and strip, along with typical applications. 25

COOLANT FILTERS—Industrial Filtration Co., Lebanon, Ind. Folder on Delpark coolant filters for use on Besly grinding machines. How the Delpark filter operates is explained. 26

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THREAD GAGING—Taft-Peirce Mfg. Co., Woonsocket, R. I. Catalogue 612, describing and illustrating the Taft-Peirce Rotochek power thread gaging unit, in both a bench model and a flexible shaft model. 27

SPRINGS—Henry Miller Spring & Mfg. Co., Pittsburgh, Pa. Brochure of 32 pages describing the products and manufacturing facilities of the concern. Formulas for hot-wound helical springs and other technical data are supplied. 28

CUTTING OIL PURIFICATION—Sharples Corporation, Philadelphia, Pa. Factual answers to the question "Should I purify cutting oil in my shop" given in Bulletin 1270. Typical lay-outs of cutting-oil purification systems shown. 29

AUTOMATIC SCREW MACHINE—Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin describing the 2 1/2-inch model AW, single-spindle automatic. New features and specifications are provided, and various accessories are described. 30

SAW SHARPENING MACHINE—A. J. Marcotte Co., Chicago, Ill. Circular dealing with jointing, gumming, sharpening, and setting of circular saws, and with the grinding of planer and jointer knives, plane irons, and wood chisels. 31

TOOL-HOLDER—Brookfield, Inc., Boston, Mass. Tool-holders designed for use on No. 00 Brown & Sharpe automatic screw machines described on catalogue sheet. Such features mentioned are adjustable V-jaw, balanced-pressure locking assembly, and smaller physical outline. ..32

COOLANT FILTERS—Industrial Filtration Co., Lebanon, Ind. Delpark coolant filters available for Micromatic machines described in 4-page folder. Late models of Micromatic machines are illustrated and filter specifications provided. 33

SERVO VALVES—Moog Valve Co., Inc., East Aurora, N. Y. Bulletin 500, on the Model 500 series electro-hydraulic servo valves for use in control systems requiring high accuracy. 34

METAL-SAWING MACHINES—Peerless Machine Co., Racine, Wis. Bulletin MC-51B, describing Mechani-Cut metal-sawing machines. A chart showing recommended operating factors is included. 35

TAPPING AND THREADING EQUIPMENT—Lassy Tool Co., Plainville, Conn. Circular descriptive of three models of hand tappers. Various methods for lathe tapping and threading are shown. 36

FLEXIBLE COUPLINGS—Lovejoy Flexible Coupling Co., Chicago, Ill. Catalogue 1009 on various types of Lovejoy flexible couplings, giving specifications and dimensions. 37

MACHINING AMPCO METAL—Ampco Metal Inc., Milwaukee, Wis. Bulletin 66a, presenting data on the proper methods for the machining of various grades of Ampco metal. 38

STAMPINGS, SMALL QUANTITY—Federal Tool & Mfg. Co., Minneapolis, Minn. Information on die and stamping costs for small quantities of stampings presented. Samples of typical stampings are available 39

RE-BUILT MACHINE TOOLS—Simmons Machine Tool Corporation, Albany, N. Y. Bulletin outlining manufacturing facilities for contract machining and rebuilding of machine tools. 40

AIR AND HYDRAULIC CYLINDERS—Lindberg Engineering Co., Chicago, Ill. Heavy-duty air and hydraulic cylinders described in bulletin No. 800. Standard and custom-built, heavy-duty cylinders are included. 41

WHEELS FOR GRINDING CARBIDE TOOLS—Fuller Merriam Co., West Haven, Conn. Si-Clone wheels for grinding carbide tools described in 4-page bulletin. Advantages and field reports cited. 42

ELECTRONIC CONTROLLERS—Tinius Olsen Testing Machine Co., Willow Grove, Pa. Bulletin 48, featuring a new line of automatic testing programs of electronic controllers. 43

STEEL CASTINGS—Lebanon Steel Foundry, Lebanon, Pa. Circle L slide chart, giving reference data on nineteen Lebanon carbon and low-alloy steel castings and seventeen stainless and corrosion-resistant grades. 44

HIGH-STRENGTH STEEL—International Nickel Co., Inc., New York City. Bulletin A-173, a reprint entitled "Ultra High Strength Steel for Aircraft Structures," evaluating properties of Type 4340 steel heat-treated to between 260,000 and 280,000 pounds per square inch for aircraft structures. 45

STRAIGHTENING EQUIPMENT—Sutton Engineering Co., Bellefonte, Pa. Bulletin 25, on Sutton straighteners for tubes and pipe, for round bars, and for flats and shapes. 46

BENDING MACHINES—Pedrick Tool & Machine Co., Inc., Philadelphia, Pa. Catalogue 53, on Pedrick production benders which will bend pipes, tubes, strips, or shapes. 47

HOLE PUNCHING UNITS—Wales-Strippit Corporation, North Tonawanda, N. Y. Bulletin JD, descriptive of Wales hole punching units for punching mild steel up to 1/4 inch thick. 48

DUST COLLECTOR—Pangborn Corporation, Hagerstown, Md. Bulletin 916 on the Pangborn unit type CN cloth bag dust collector with an explanation of how it works. 49

SCALE MODELS—Knight Models, Inc., Chicago, Ill. Folder showing how three-dimensional scale models can be used in plant lay-out, in product development, and as sales aids. 50

CARBON AND ALLOY STEELS—Empire Steel Castings, Inc., Reading, Pa. Bulletin 253-LA consisting of a designation chart for carbon and low-alloy steel castings. 51

MOUNTED WHEELS—Metal Removal Co., Chicago, Ill. Catalogue 30, describing the company's line of porcelain and resinoid-bonded mounted wheels, and suggesting typical uses. 52

FEED AND SPEED CALCULATOR—Wendt-Sonis Co., Hannibal, Mo. Feed and speed calculator suitable for all carbide machining operations; also a carbide grade chart. 53

COLLET TYPE MANDREL—E. Westberg Corporation, Syracuse, N. Y. Folder descriptive of the Colletmandrel, a collet that grips the work-piece from the inside surface. 54

HYDRAULIC CYLINDERS—Hydro-Line Mfg. Co., Rockford, Ill. Bulletin 53, describing the Series "J" hydraulic cylinders, with detailed drawings of various mounts. 55

SCREW MACHINE PARTS—Conklin Swiss Screw Machine Co., Chicago, Ill. Booklet describing the company's facilities for producing intricate precision parts. 56

FLEXIBLE SHAFT MACHINES—Stow Mfg. Co., Binghamton, N. Y. Catalogue 51, descriptive of Stow flexible shaft equipment for use in many machine shop applications 57

LUBRICANT—Alpha Corporation, Greenwich, Conn. Bulletin 101, covering Molykote, Type BR-2, a multiple-purpose extreme pressure lubricant. 58

GUN DRILLS—Eldorado Tool & Mfg. Corporation, Milford, Conn. Booklet explaining how gun drills can be used for solving difficult drilling problems. 59

FLAME-CUTTING—Air Reduction Sales Co., New York City, 12-page reprint entitled "Advanced Automatic Flame Cutting for Machinery Weldments." 60

WELDING GUN—Air Reduction Sales Co., New York City. Folder ADC 834 on the Aircospot gun, a water-cooled manual welding unit for easy manipulation in any welding position. 61

CURIE TEMPERATURE ALLOYS—International Nickel Co., Inc., New York City. Bulletin A-167, reprint containing data on the Curie temperature (the temperature at which a magnetic alloy becomes non-magnetic) of many alloys. 62

MACHINE SHOP FACILITIES—Franklin Balmar Corporation, Baltimore, Md. Catalogue describing foundry and machine shop facilities available on a contract basis at Franklin Balmar. 63

CONTROL CENTERS—Clark Controller Co., Cleveland, Ohio. A 24-page booklet describing advantages of Clark centralized electrical control systems, and giving typical installations and planning tips. 64

HOSE CLAMPS—Punch-Lok Co., Chicago, Ill. Booklet entitled "Clampways Ideas," giving case histories of unusual uses for Punch-Lok hose clamps. 65

CAM FOLLOWER—Smith Bearing Co., Trenton, N. J. Folder giving load and life ratings for the company's high-capacity stud and regular type cam followers. 66

DETERMINING CENTER HOLE SIZES—Ready Tool Co., Bridgeport, Conn. Engineer's Master Chart, a guide for drilling correct center holes. 67

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

Circle numbers of the catalogue items in which you are interested.

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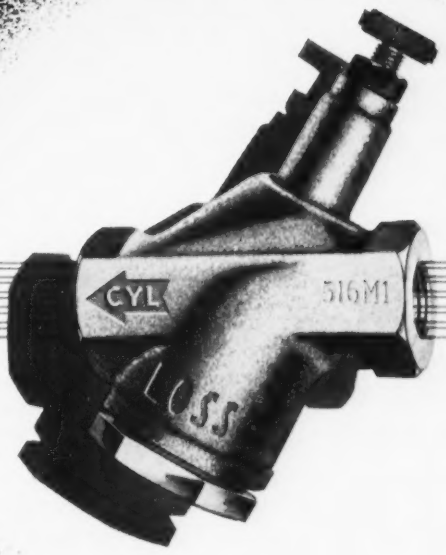

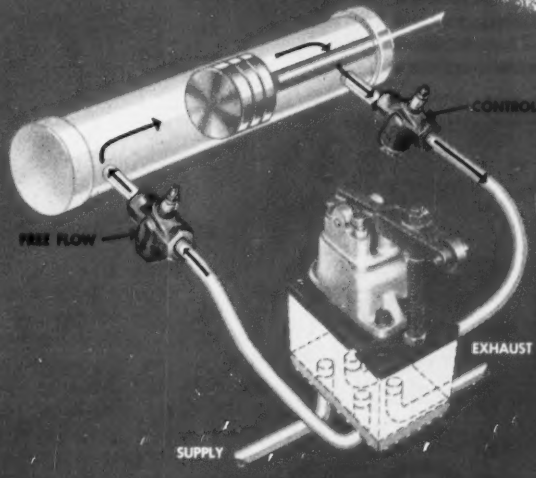

Write for Bulletin 305A

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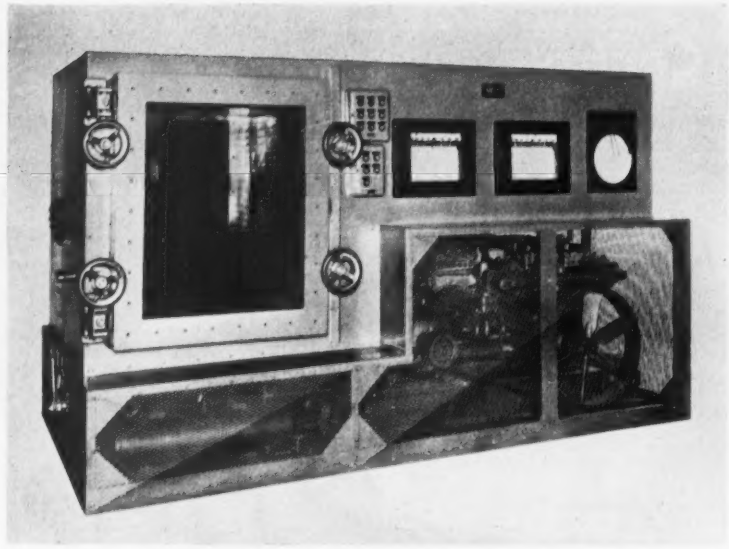


Automatically controlled testing chamber has been brought out by the American Research Corporation

Testing Chamber with Automatic Controls

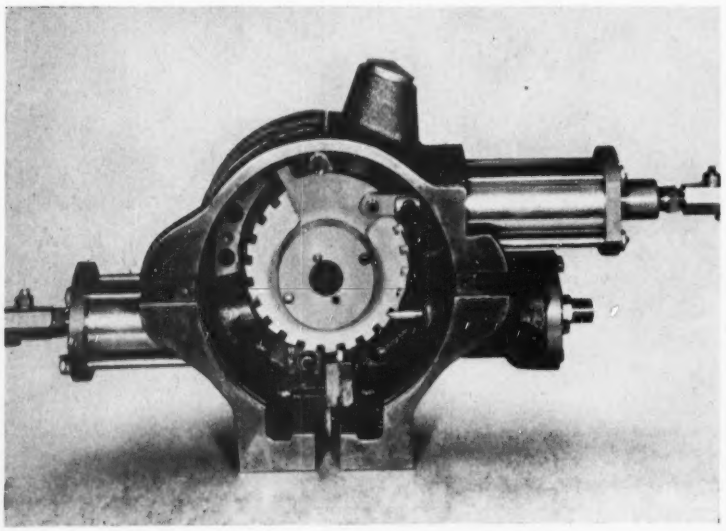
The American Research Corporation, Dept. M, Bristol, Conn., has just delivered to an electrical manufacturer an environmental simulation chamber that will provide up to 7 1/2 pounds per square inch positive pressure in addition to automatically controlled temperature-altitude-humidity simulation. Temperatures from +185 degrees F. to −100 degrees F. can be maintained at pressures simulating altitudes up to 60,000 feet. Other features include automatically controlled relative humidity from 20 to 100 per cent, automatic control of pressure and altitudes, and automatic draining of all humidity devices below freezing.

Erickson Speed Indexers

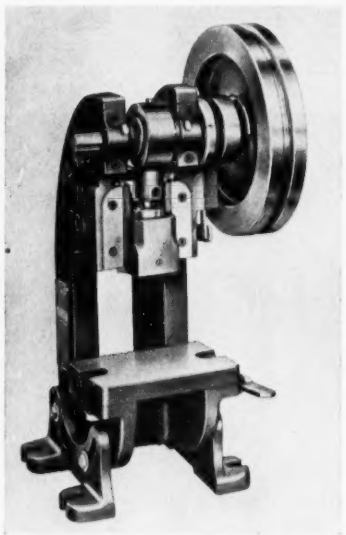
The Erickson Tool Co., 2319Q Hamilton Ave., Cleveland 14, Ohio, is manufacturing a speed indexer with a built-in protective device that is easily adjustable to meet shock conditions imposed by varying loads. This device is said to assure constant, uniform feeding and at the same time permit maximum speeds to be used without danger of damage to the mechanism or work. The piston of the control unit shown at the upper right in the illustration is linked directly to the indexing mechanism and is self-contained.

All Erickson indexers may be operated by either air or hydraulic fluid, and can be used either vertically or horizontally. They can be connected to table controls on the machine tool for fully automatic operation.

The standard index-plate provides for indexing to four, six, eight, twelve, and twenty-four positions. By the use of special indexing parts, up to 100 positions can be obtained. For accurate 120-degree positioning, there is a three-position indexer.



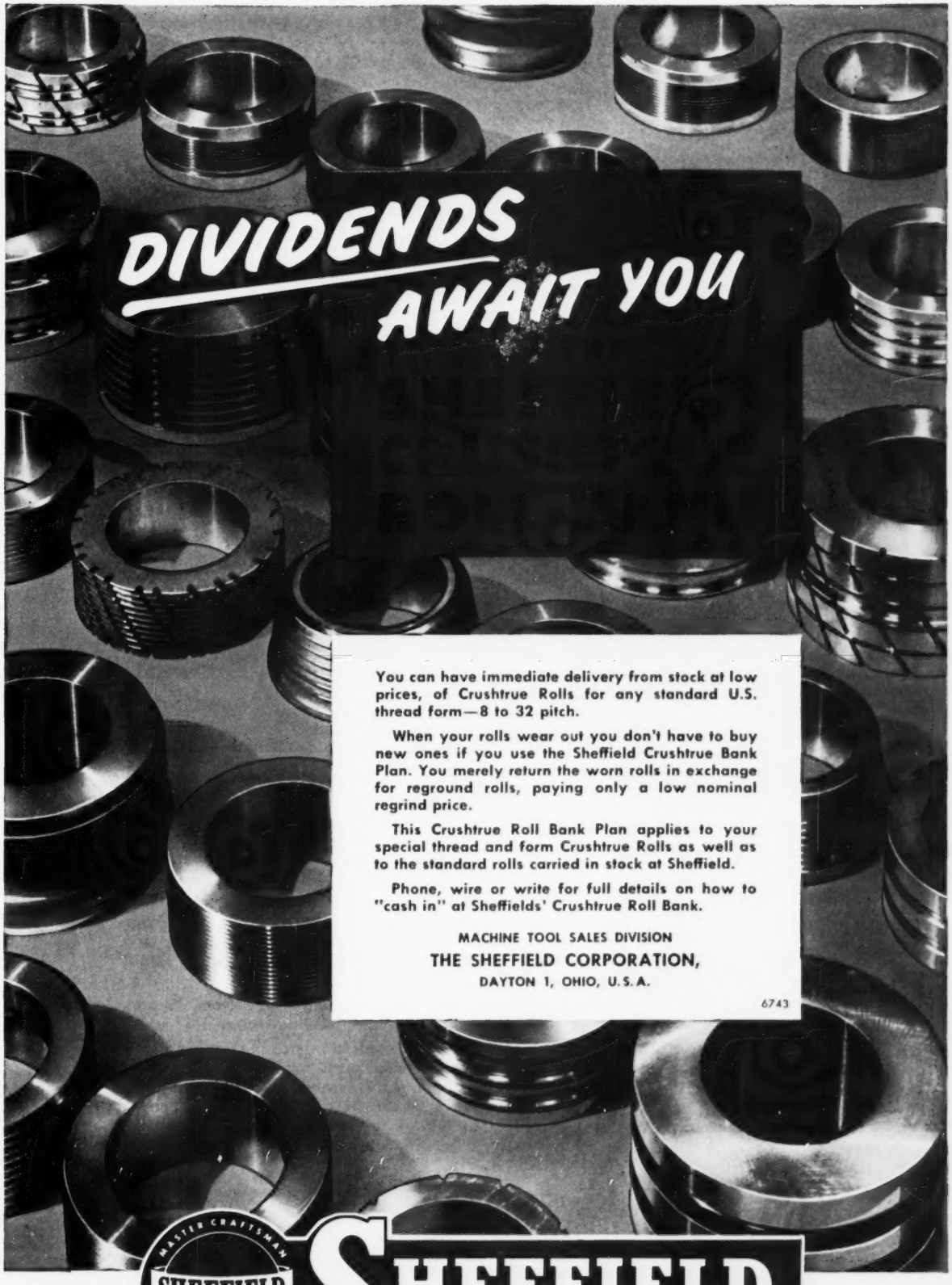
Erickson high speed indexer with shock control unit



Kenco midget punch press

Midget Punch Press

The Kenco Mfg. Co., Dept. M, 5211 Telegraph Road, Los Angeles 22, Calif., is marketing a precision-built, midget punch press that follows the general lines of their 4- and 5-ton presses. This 1 1/2-ton open-back inclinable press has a solid crankshaft of alloy steel, heat-treated and precision-ground; a roller-bearing mounted flywheel; a self-contained clutch mechanism; a drive collar made of alloy steel, heat-treated and ground; and connecting-rod and crankshaft bearings of special alloy bronze. Regularly made with a 3/4-inch stroke, but can be had with 1-inch stroke.



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When your rolls wear out you don't have to buy new ones if you use the Sheffield Crushtrue Bank Plan. You merely return the worn rolls in exchange for reground rolls, paying only a low nominal regrind price.

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Phone, wire or write for full details on how to "cash in" at Sheffields' Crushtrue Roll Bank.

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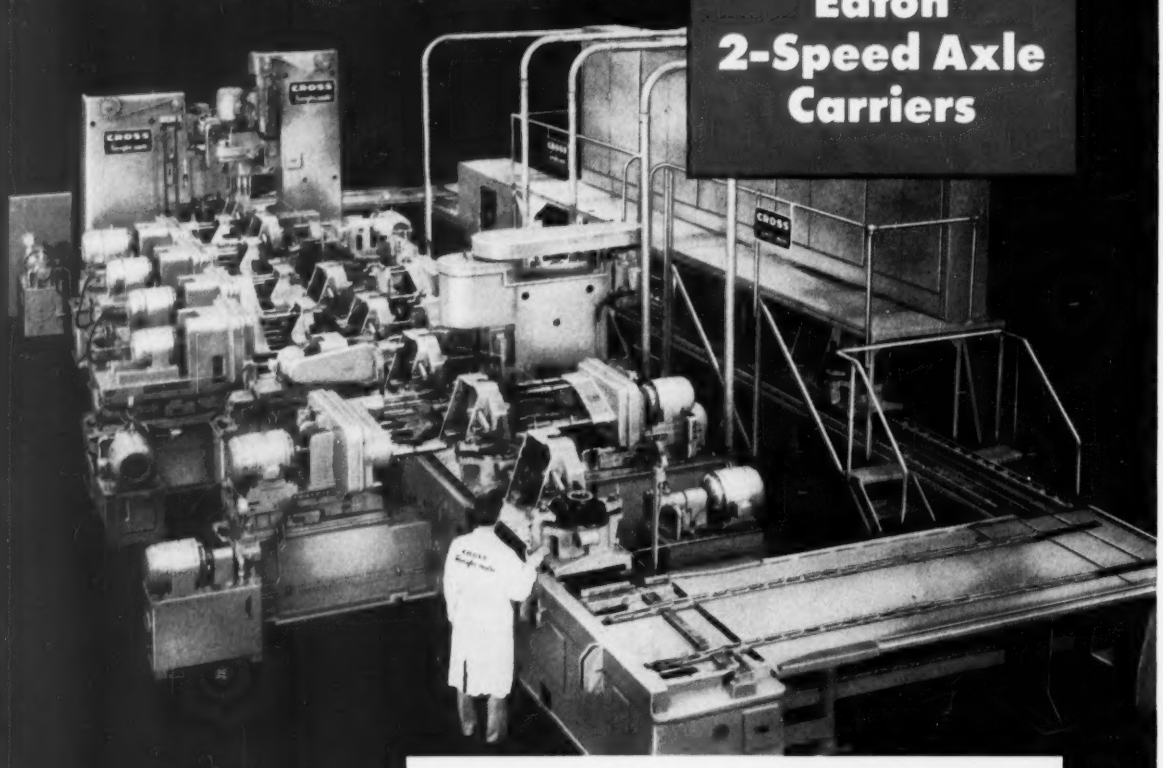

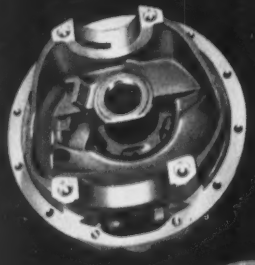

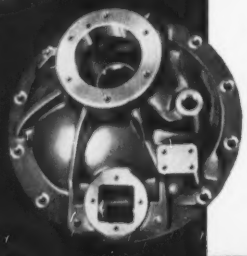

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- ★ 97 operations: 60 drilling, chamfering and reaming; 5 milling; 4 spotfacing and counterboring; 28 tapping.
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- ★ Two-position, progressive type work holding fixtures with automatic transfer from station to station and integral conveyor for automatic return from unloading to loading station.
- ★ Cleaning unit for removing chips from fixtures between unloading and loading station.
- ★ Other features: Complete interchangeability of all standard and special parts for easy maintenance; construction to J.I.C. standards; hardened and ground ways; hydraulic feed and rapid traverse; individual lead screw feed for tapping; coolant system; automatic lubrication.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 247

Between Grinds

By E. S. Salichs

Old Style Rainmaker

The Thunderbird, a new kind of personal car, will be put into production by the Ford Motor Co. next fall. The name is significant in that the Thunderbird is considered an omen of good luck. According to North American Indians, no man could see this symbolic bird except in flashes as it flew through the clouds with arrows of lightning bolts tucked beneath its wings. A flap of the wing released the guided missiles and in disturbing the atmosphere created rain for the parched land.

But Seldom Get

Among the booklets on information racks at the General Motors plants will be one entitled "Pies Men Like," with ten natural-color photographs. Burnt offerings had been purposely overlooked as models.

Clean Crystal

A bright future is ahead for the industrial cleaning and metal-treating field, according to John A. Carter, president of Oakite Products, Inc. His confidence was cheerfully expressed in a talk at the company's annual conference, and reinforced by citing Oakite's continuing expansion program.

A Laboratory Retriever

A powerful, pocket-sized magnet is now made by the Eriez Mfg. Co. to be used as a recovery tool for anyone who works with metal—whether it be the lab, shop, or even your own garage.

Ball and Chain Maker?

An advertisement in a technical European journal sought the services of an ambitious young executive to be on the staff of a firm, with the inducement of "possibility to marry into the proprietor's family." This call to arms and charms was reported by a correspondent to British MACHINERY.

No Spokes for Folks

A silicone water repellent for suits and clothes became one of the Fabulous Facts described in an anniversary booklet of the Dow Corning Corporation. To quote: "You may go about singing in the rain because you will be wearing your umbrella."

Call to Creators

Inventors of practical products will have a chance to demonstrate them on May 3 at an Invention Exhibit and Conference. The deadline for brain children is April 1. (For details, write to Invention Conference Group, Cleveland Engineering Society, 2136 E. 19th St., Cleveland 15, Ohio.)

INDUSTRY AND EDUCATION MEET ON CAMPUS—A traveling truck exhibit of the Eastman Kodak Co., known as "Optics for Industry" and featuring two contour projectors used for the quick inspection of mechanical parts, was recently invited to Purdue University. Applications and advantages of the contour projectors were covered by a movie and a talk illustrated by display panels. Obviously, the truck could not hold 350 engineering students, so a TV camera and screen were borrowed and the exhibit projected in the classroom. Two shows a day were held for students, faculty members, and representatives of near-by industries. Open house was also held in the truck for two days—so people could see what they saw.

News

California and Oregon

EDWARD R. BURKARDT has been appointed sales representative in southern California for J. H. Williams & Co., Buffalo, N. Y., manufacturers of wrenches, tools, and drop forgings. Mr. Burkardt will report to the company's district office in Los Angeles.

TECH-PACIFIC CORPORATION, 3416 Via Lido, Newport Beach, Calif., is a newly organized distributor in the West for Swedish and American precision machine tools. CURT W. BOHMAN and JOSEPH J. MUSIL formed the concern.

LOUIS LEVIN & SON, INC., Los Angeles, Calif., have completed a new 7500-square-foot building at 3610 S. Broadway in Los Angeles for the production of miniature precision lathes and tools.

HANCHETT MFG. CO., Big Rapids, Mich., manufacturer of saw sharpening and knife grinding machines, recently opened its West Coast plant and warehouse, located at 5727 S. W. Macadam Ave., Portland 1, Ore. H. E. DARLING will be manager; WALTER NOACK, plant superintendent; and HUGH MILLER, sales engineer on the staff.

Illinois and Indiana

ROBERT L. LARSON has been named manager of the Alloy Steel Division of Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. Larson, who will have his headquarters in Chicago, was formerly manager of alloy steel sales in the Chicago plant. Succeeding him there is WILLIAM P. LOEHRER, who was formerly a representative for the alloy and stainless steel department. MARTIN J. HARTIGAN has been named manager of supply purchases. He has been with Ryerson since 1917, and was manager of the mill and factory sales department at the time of his appointment. Functions of this department have now been taken over by other divisions of the company.

ILLINOIS TOOL WORKS, Chicago, Ill., announces that its Shakeproof Division has been subdivided into three units as follows: Standard Products, under the direction of ANDREW L. PONTIUS, formerly works manager of the Shakeproof Division; Special Stamped Products, with CARL F. JENSEN as manager—Mr. Jensen having been plant manager of the Des Plaines, Ill., plant; and Plastic Products, with SILAS S. CATHCART as manager.

GEORGE W. STEINMETZ has been appointed sales manager of the Chuck Division of Supreme Products, Inc., Chicago, Ill. Mr. Steinmetz was assistant sales manager at the Standard Tools Co., Cleveland, Ohio, before joining Supreme Products, Inc. He will have his headquarters in Chicago and direct sales on a national basis.

MARSHALL STEEL CO., La Grange, Ill., has now added 27,000 square feet to its factory. The company is manufacturing a new line of low-carbon ground flat stock, as well as the Aristocrat line, and is also offering a low-carbon plate grinding service.

ROBERT VON ROTZ has been appointed chief engineer of the Tuthill Pump Co., Chicago, Ill. Prior to joining the organization, Mr. Von Rotz served as chief engineer with the Applied Research & Development Corporation, New York City, and Berne, Switzerland. His engineering background covers a period of twenty-seven years in research, development, and design in both the low- and high-pressure pump fields.

Robert Von Rotz, chief engineer of the Tuthill Pump Co.

Carl E. Overton, vice-president in charge of sales for the Brad Foote Gear Works, Inc.

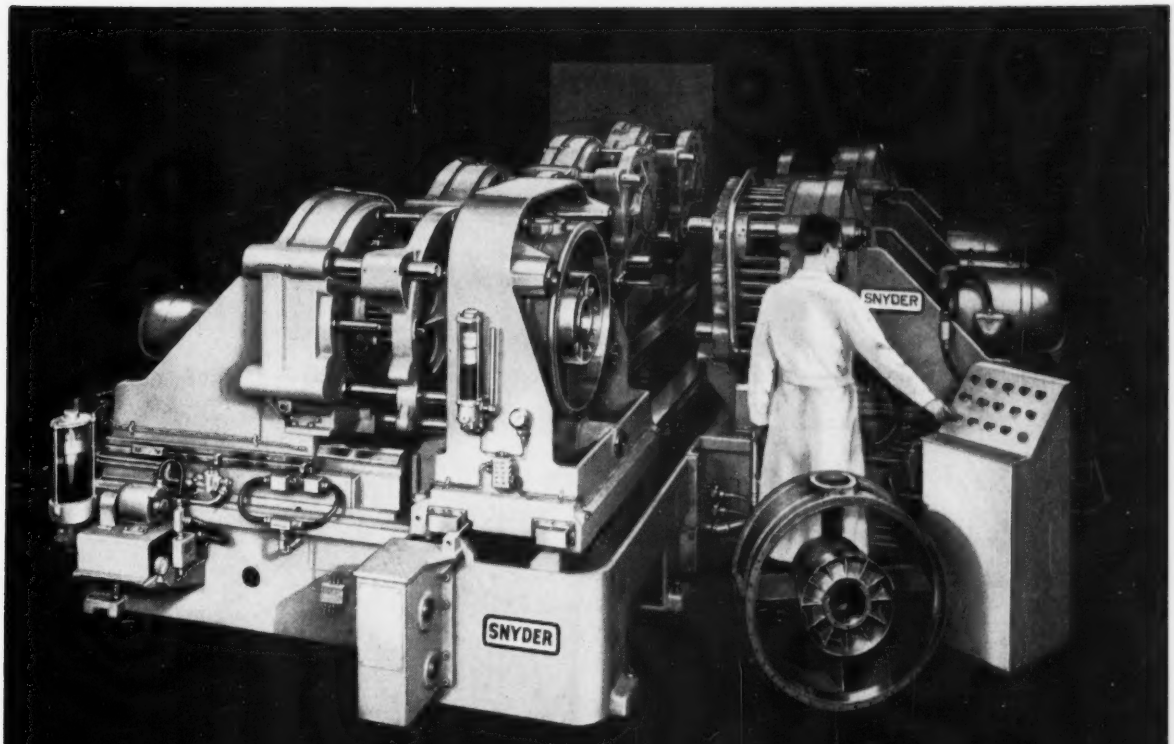
CARL E. OVERTON was recently elected vice-president in charge of sales by the Brad Foote Gear Works, Inc., Cicero, Ill. Mr. Overton joined the organization as a sales engineer in 1948, and was made works manager the following year. In 1950, he became sales manager.

OILGEAR CO., Milwaukee, Wis has opened an office at 4754 W. Washington Blvd., Chicago 44, Ill., to serve eastern Illinois and Indiana. VITIOUS P. JURKONIS, who has been a Midwest engineering representative since 1946, will be in charge.

WILLIAM B. POWELL has joined the Borg-Warner Corporation, Chicago, Ill., having been appointed director of industrial relations for the Mechanics Universal Joint Division at Rockford, Ill.

CARLON PRODUCTS CORPORATION, Cleveland, Ohio, has appointed JOSEPH T. RYERSON & SON, INC., Chicago, Ill., steel service organization, distributor for Carlon plastic pipe and fittings.

EUGENE J. LAPORTE was recently appointed assistant to the sales division manager in the Chicago, Ill., office of the Cleco Division of Reed Roller Bit Co., Houston, Tex. Mr. LaPorte has served as salesman for the portable air tool firm since



SNYDER SPECIAL

4-STATION, AUTOMATIC LINE INDEX

MACHINE DRILLS, REAMS, CHAMFERS

420 HOLES AN HOUR IN SIX LARGE

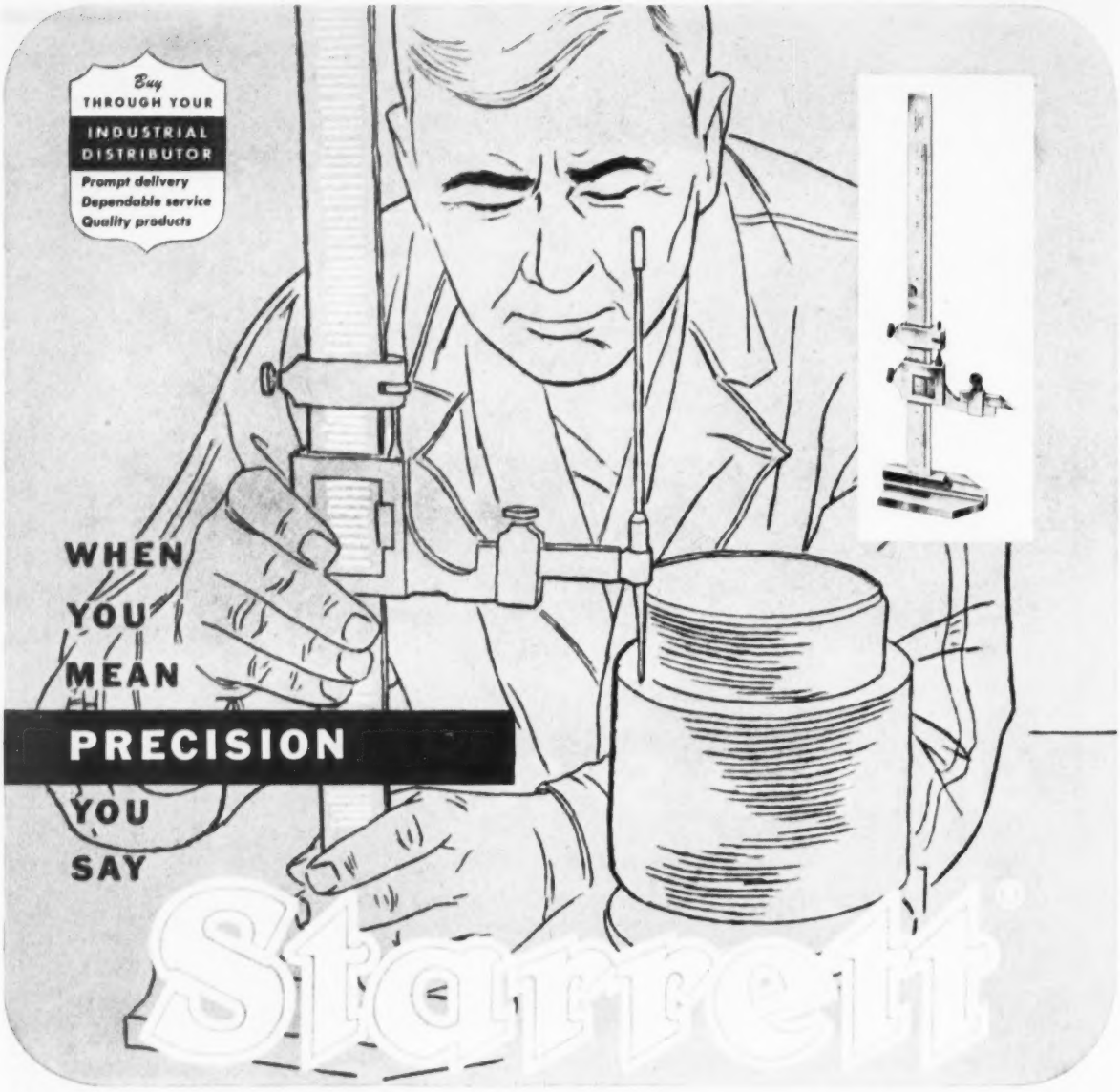
CAST ALUMINUM AIRCRAFT PARTS

AT 80% EFFICIENCY.

SNYDER

TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan

29 Years of Successful Cooperation with Leading American Industries



Call your INDUSTRIAL DISTRIBUTOR for prompt, dependable, quality service to match the quality and dependability of Starrett products.

When it comes to precision measuring tools — the tools that set your company's standard of accuracy — you have complete confidence in Starrett. It is the name you specify, the name you look for before all others on tools you trust. Starrett makes more than 3000 fine tools for every precision measuring need . . . 3000 opportunities to buy with confidence through a convenient and reliable source of supply — your Industrial Distributor.

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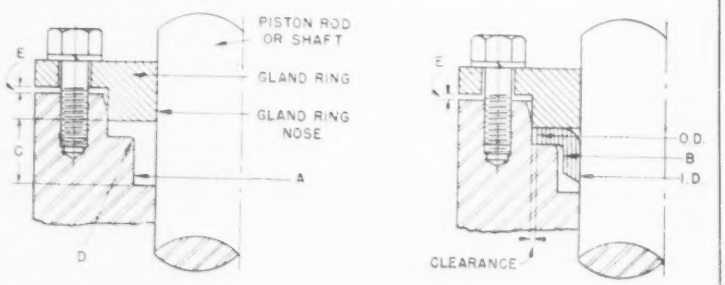
"WORLD'S GREATEST TOOLMAKERS"

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS • DIAL INDICATORS • STEEL TAPES
PRECISION GROUND FLAT STOCK • HACKSAWS, BAND SAWS and BAND KNIVES
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

For more information on products advertised, use Inquiry Card, page 247

RECOMMENDED CLEARANCES FOR LEATHER FLANGE PACKINGS



The outside diameter (O.D.) of the flange packing should be slightly less (not over 1/16 inch) than the diameter of the recess into which it fits.

Recess diameter *A* should equal the diameter of the piston rod or shaft plus twice the wall thickness of the flange packing (this sum equals dimension *B*), plus the recommended clearance given in Table 1.

Recess depth *C* should at least equal the height of the packing plus the thickness of the leather. Sharp corner *D* should be broken or rounded. Fluting or serrating of the shoulder in the recess will aid in anchoring the flange packing in position.

Minimum clearance between the piston shaft or rod and the gland ring should be as shown in Table 2.

Length of the nose on the gland ring should be sufficient to insure a clearance *E* equal to that recommended in Table 1.

Table 1. Recommended Clearances, where T = Leather Thickness

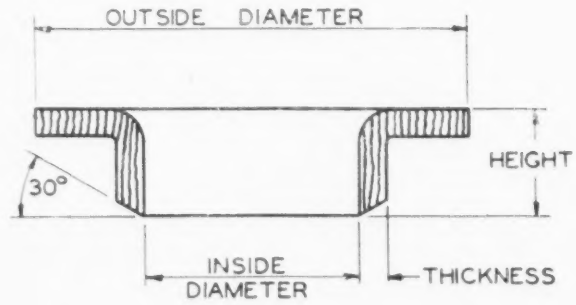
Medium to be Sealed	Water	Oil	Air
Clearance on Each Side	0.33T	0.25T	0.25T

Table 2. Minimum Clearances between Piston Shaft and Gland Ring

Plunger Diameter, Inches	1 to 5	6 to 10	12 to 18	20 to 32	36 and over
Clearance on Diameter, Inch	0.003	0.004	0.005	0.006	0.007

Compiled by the American Leather Belting Association

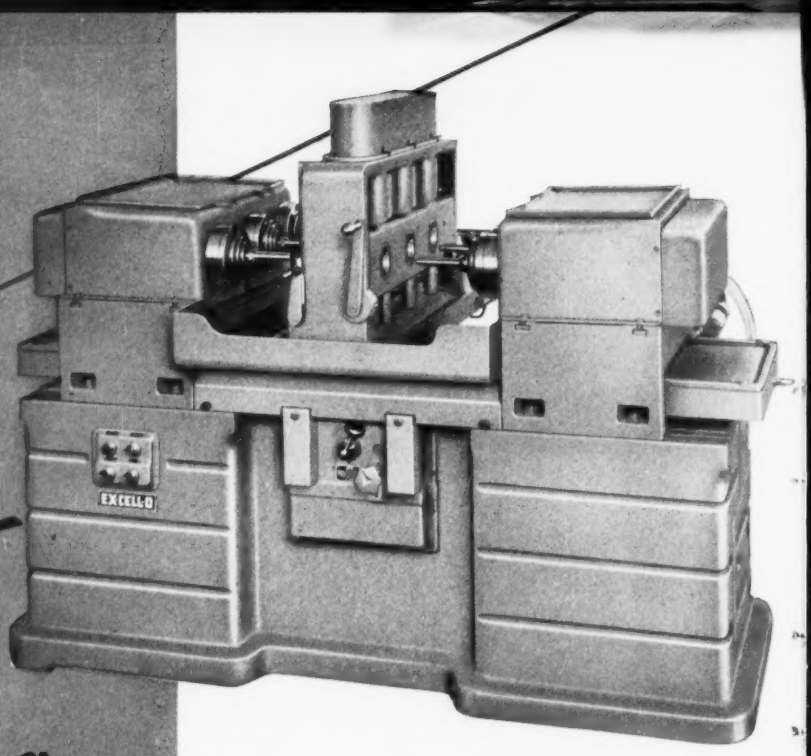
RECOMMENDED DIMENSIONS FOR LEATHER FLANGE PACKINGS



Inside Diameter, Inches	Height of Packing, Inches	Thickness of Leather, Inch	
		Minimum	Maximum
1/2	1/4	1/32	1/16
3/4	5/16	1/32	1/16
1	1/2	1/32	3/32
2	1/2	1/16	1/8
3	5/8	3/32	5/32
4	5/8	3/32	5/32
5	3/4	3/32	5/32
6	3/4	1/8	3/16
7	3/4	1/8	3/16
8	1	1/8	3/16
9	1	1/8	3/16
10	1	1/8	3/16
12	1 1/4	1/8	3/16
14	1 1/4	1/8	3/16
16	1 1/2	1/8	3/16
18	1 1/2	1/8	3/16
20	1 3/4	1/8	3/16
22	1 3/4	1/8	3/16
over 24	2	1/8	3/16

Compiled by the American Leather Belting Association

Style 17 Ex-Cell-O Precision Boring Machine equipped with new, inbuilt motor spindles for semifinish and finish-boring of wrist pin holes in automotive pistons.



Vibration-Free Boring

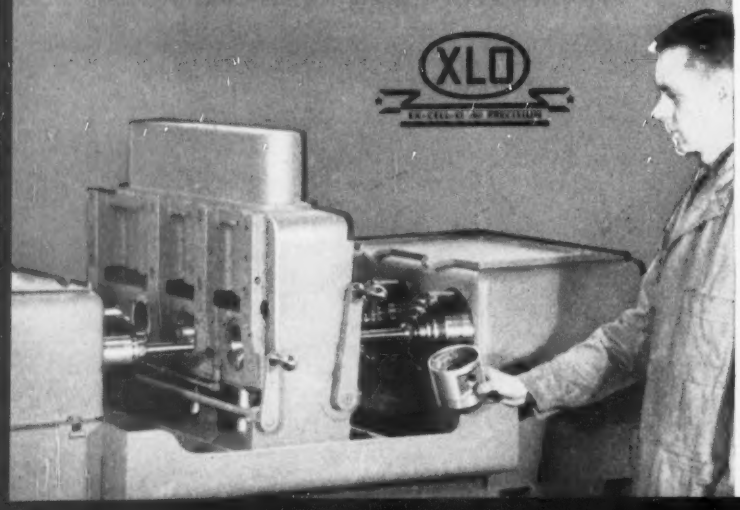
NEW INBUILT-MOTOR SPINDLES ON EX-CELL-O PRECISION BORING MACHINE ASSURE FAST, ACCURATE FINISHING OF PISTON PIN HOLES

Wrist pin holes in automotive pistons are given exceptionally fine surface finish by this Style 17 Precision Boring Machine equipped with inbuilt-motor spindles. Diameters are held within .0003" total tolerance. The inbuilt motor positively eliminates any vibration that might originate in belts and pulleys.

The thin walled parts are held firmly, yet without distortion in a fixture which provides perfect alignment for bores through both bosses. Interchangeable locators are provided to accommodate two sizes of pistons. This machine both semifinishes and finish-bores the pin holes. Production rate is high.

For further information on the many uses to be made of Ex-Cell-O Precision Boring Machines, see your local Ex-Cell-O representative or write today for Bulletin 31205.

The machine table feeds to the left for semifinish-boring, then to the right for finish-boring, assuring uniform stock removal for the finishing cut. New inbuilt-motor precision boring spindles are rigid and smooth running. Coolant is manifolded through the covers on both sides of the pistons.



EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS CUTTING TOOLS • RAILROAD PINS AND BUSHINGS DRILL JIG BUSHINGS • DAIRY EQUIPMENT AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS

53-21

1951. J. T. ROBERTS, senior salesman for the company in the Kansas City area, is being appointed as salesman in the North Central sales division at Chicago, the position formerly held by Mr. LaPorte.

PANELLIT, INC., Chicago, Ill., manufacturer of industrial automatic control and information systems, has begun construction of a new plant located at 7401 Hamlin, Skokie, Ill.

RICHARD H. EWERT has become general sales manager for the Illinois Gear & Machine Co., Chicago.

GEORGE L. GUYMON, vice-president and director of sales of the Industrial Filtration Co., Lebanon, Ind., has been elected to the board of directors. Mr. Guymon introduced the Delpark automatic filter to the trade in 1950.

JAMES G. RICHMOND has been named assistant manager of the manufacturing division of the Indiana Steel Products Co., Valparaiso, Ind., permanent magnet manufacturer. JAMES R. IRELAND has been made assistant director of research.

Michigan

GLEN HARMON, assistant chief engineer for the Colonial Broach Co., Detroit, Mich., has been given new top-level engineering duties. Mr. Harmon joined the company in 1935, and has been assistant chief engineer for the last four years. Also announced was the appointment of EARL ("DUTCH") CLARK as sales representative in the Detroit, Mich., area. Mr. Clark was formerly athletic director and football coach for the University of Detroit.

FRANCIS R. FLOOD has been named a sales engineer specializing in chrome carbides by the Carboloy Department of General Electric Co., Detroit, Mich. Mr. Flood was formerly in the product planning section. FRANK M. MANSFIELD, III, has joined the Department as manager of product programming. Previously, he had been Detroit district engineer for the Torrington Co.

RALPH E. CROSS, executive vice-president of The Cross Company, Detroit, Mich., machine tool builder, was recently named director of the Metal-Working Equipment Division, Business and Defense Services Administration, United States Department of Commerce—a new administration set up to coordinate the activities of government and business. Mr. Cross will be located in the Commerce Bldg., Washington, D. C., serving under an arrangement whereby outstanding businessmen

Ralph E. Cross, executive vice-president of The Cross Company, named Director of Metal-Working Equipment Division, B.D.S.A.

work for the Government without compensation on a rotating basis. Mr. Cross is the originator of a number of developments in automation, as well as in milling, drilling, boring, gear chamfering, and shell turning machines.

MORSE CHAIN CO., Detroit, Mich., has established a Midwestern sales territory at Overland Park, Kan., with C. B. LANE, newly appointed factory representative, as head. Also announced by the company was the appointment of R. J. DONACHIE as manager of the Philadelphia office, which will occupy new quarters at 9 Union Ave., Bala-Cynwyd, Pa.

KENNAMETAL, INC., Latrobe, Pa., recently announced plans for a manufacturing plant in the Detroit area, the address of which will be 10201 Capital Ave., Oak Park, Mich. The new plant will produce tungsten-carbide tools and specialties.

A. D. ARNAUT has been named New York sales engineer by the Wall Colmonoy Corporation, Detroit, Mich., his headquarters being at the company's office in Linden, N. J. M. R. PRICE has become affiliated with Wall Colmonoy as sales engineer at Pittsburgh, Pa.

EUGENE N. JARVIS has been named factory sales and service representative in southeastern Michigan by the Grav-i-Flo Corporation, Sturgis, Mich., manufacturer of barrel tumbling equipment. Mr. Jarvis will have his headquarters at the Wagner Brothers Co., 400 Midland Ave., Detroit, Mich.

EDWARD J. PRATT and JOHN S. GORSKI have been appointed first and second vice-presidents, respectively, by the Amco Gage Co., Detroit, Mich. Mr. Pratt is general manager of the company and Mr. Gorski, general superintendent.

THOMAS HAMILTON has been named salesman in the Detroit, Mich., area by the Clearing Machine Corporation, Chicago, Ill. Mr. Hamilton will have his headquarters at the company's Detroit office. He has been with Clearing since 1938.

H. E. B. MACHINE TOOLS, INC., New York City, announce that the H. E. B. automatic copying lathe will now be built in this country by the Industrial Metal Products Corporation, Lansing, Mich.

R. G. ELLIS has been promoted to assistant chief engineer of the Micromatic Hone Corporation, Detroit, Mich. Mr. Ellis, who is in the engineering department, has been with the concern since 1939.

FRANK M. HUNTER has been named service engineer for northern and lower Michigan by the Acheson Colloids Co., Port Huron, Mich. He will have his quarters at 3000 E. Grand Blvd., Detroit.

WILLIAM R. PLUMMER is joining the Garland Mfg. Co., Detroit, Mich., in the capacity of general sales manager. He was formerly with the Progressive Welder Sales Co., Detroit, Mich.

Minnesota and Wisconsin

LATROBE STEEL CO., Latrobe, Pa., tool steel producer, has opened an office in St. Paul, Minn., serving Minnesota, North and South Dakota, Nebraska, and northern Iowa. JAMES TERRY, who formerly represented the company in Cincinnati, Ohio, will be in charge.

METALLURGICAL, INC., has opened a new metal-treating plant at Minneapolis, Minn., the occasion being celebrated on the tenth anniversary of the firm.

FALK CORPORATION, Milwaukee, Wis., announces the following promotions: CARL F. HAERTEL, former general foundry superintendent, becomes divisional works manager of the foundry and weld shop; FOSTER C. KOEHN, plant engineer, is now director of plant engineering; B. C. BUGBEE, JR., machine shop general superintendent, becomes divisional works manager of machine shops and general services; and CHARLES FUERST, assistant foundry superintendent, is general foundry superintendent.

S. H. SMITH, district manager at Milwaukee, Wis., for the Air Re-

duction Sales Co., New York City, recently retired after thirty-eight years of service in the oxy-acetylene industry. G. J. DEKKER, formerly district manager at St. Louis, Mo., succeeds Mr. Smith. He has been with the company for thirty-five years.

New England

HELGE G. HOGLUND has resigned as vice-president in charge of sales of the Hendey Machine Co., Inc., Torrington, Conn. He had been with Hendey for a year and a half. Also announced was the retirement of FRANK J. MCCARTY as general sales manager and the promotion of CHARLES A. TORSON to this post. Mr. McCarty was associated with Hendey for the last twenty-six years as general sales manager. Mr. Torson was assistant sales manager at the time of his promotion.

NELCO TOOL CO., Manchester, Conn., has purchased the MODERN TOOLS Co., Berlin, Conn., which will be known as the Modern Tools Division of the Nelco Tool Co. and continue to produce high-speed steel and carbide tools, milling cutters, and now Nelco carbide cutting tools. WILLIAM A. COE has been appointed general manager of the Berlin plant. HANS NELSON, former president of the Modern Tools Co., will continue in an advisory capacity.

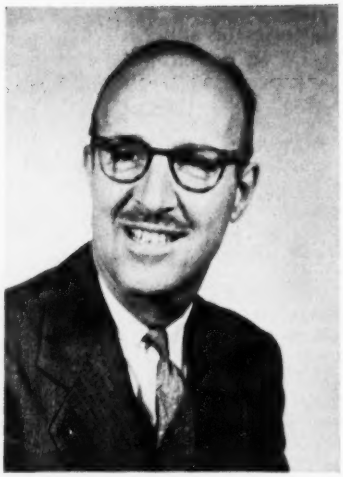
CLIFFORD G. STROTE has been appointed director of purchases of the American Chain & Cable Co., Inc., Bridgeport, Conn. He will handle all purchasing for the sixteen divisions of the company from his headquarters at Bridgeport. Mr. Strote previously held executive purchasing assignments with the United States Steel Corporation. M. C. NESS has been named assistant director of purchases. A. C. CURRAN has resigned.

M. K. PECK has been named assistant sales manager of the Bullard Co., Bridgeport, Conn. Mr. Peck has been with the company since 1949, and has been active in sales promotion for the Bullard horizontal boring, drilling, and milling machine.

REVERE CORPORATION OF AMERICA, Wallingford, Conn., manufacturer of precision instruments for aviation and industry, has opened a new plant in Meriden, Conn.

JOHN G. FLEMING has been appointed to the newly created position of product planning manager at the Bristol Co., Waterbury, Conn.

THOMAS HINCHLIFF has been added to the staff of the American Research Corporation, Bristol, Conn., as project engineer.



(Left) Wallace L. Howe, vice-president in charge of research and development at the Norton Co.; (right) Donald L. Price, sales manager of the Abrasive Division

WALLACE L. HOWE was recently named vice-president in charge of research and development by the Norton Co., Worcester, Mass. Mr. Howe has been associated with the company for thirty years, and at the time of his appointment was director of research and development. He has now been elected to the board of directors, together with JOHN M. COOK, vice-president and general sales manager of the Behr-Manning Corporation, a division of the Norton Co. Mr. Cook replaces HENRY M. ELLIOT, first vice-president of Behr-Manning, who has retired as a Norton director. DONALD L. PRICE has been named sales manager of the Abrasive Division. Mr. Price started with Norton in 1920. He served as an abrasive engineer in Detroit, Mich., then became district manager there. In 1949, he was recalled to Worcester and in 1952 was appointed sales manager of the Eastern Region.

RADIO FREQUENCY CO., Medfield, Mass., manufacturer of induction heaters, is building a new plant in Medfield.

BRYANT CHUCKING GRINDER CO., Springfield, Vt., manufacturer of internal grinders and boring machines, has opened three new sales offices: at Mount Vernon, N. Y., 35 Beechwood Ave., with NICK A. LEYDS as district manager; at Dayton, Ohio, 132 N. Main St., with CALEB C. BROWN as direct factory representative; and at Indianapolis, Ind., 2037 E. 46th St., under the direction of WALTER AUGUSTEN. The company also appointed BERNARD C. DAY as manager of the Cleveland, Ohio, office, at 4614 Prospect Ave., Cook Bldg.

HAROLD A. SAMPLE has joined the Carboloy Department of the General Electric Co., Detroit, Mich., as a field sales representative in the New England district, working out of Springfield, Vt. He was formerly supervisor of value analysis at the General Electric aeronautic and ordnance systems department in Burlington, Vt.

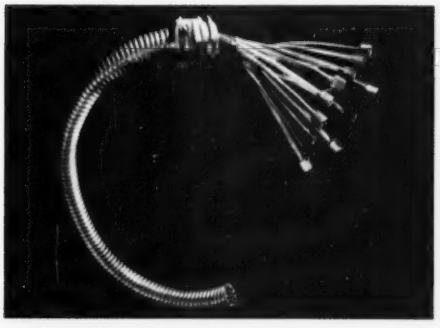
New York and New Jersey

W. J. ULRICH, senior sales representative in the Detroit, Mich., area of The Carborundum Company, Niagara Falls, N. Y., has been elected vice-president of the company. Mr. Ulrich will continue his sales activities in the Detroit area. Appointments announced by the company in the Bonded Products and Grain Division are as follows: F. W. BONACKER, assistant vice-president in charge of sales; W. J. KINGSLEY, sales manager for industrial product lines; and J. G. FRITZINGER, sales manager for special accounts. For the abrasive lines in this Division, the following district sales managers were named: F. J. MILLER, Middle Atlantic district; E. GEORGE BALL, Cleveland district; R. H. HUNTINGTON, Chicago district; and H. J. JEFFERS, Bonded Products and Grain sales manager for the Detroit district. In the Coated Products Division at Wheatfield, N. Y., JOHN F. CLAYDON was made director of the industrial sales branch, while H. P. DALES was named industrial sales manager. It was also announced that the New York and Philadelphia sales districts have been combined into a Middle Atlantic sales district, with J. A. DECKER as district sales manager. Other dis-

For the new pneumatic instrumentation

Cabled Tube

The recent tremendous increase in the use of tube instead of wires for instrumentation and control purposes has led to an important new development—cabled tube. This is an armored group of long tubes twisted together to permit bending without distortion. An insulating tape is wrapped over the bundle of tubes to prevent electrolytic action. Then interlocking, flexible galvanized steel armor is applied, like BX. This protects the tubes from injury during shipment, storage, installation, and in service. Standard fittings, boxes and cabinets can be used for junction boxes and terminations. To make it possible to readily identify each tube, one tube in each layer is colored; the position of each tube in each layer in relation to the coded tube

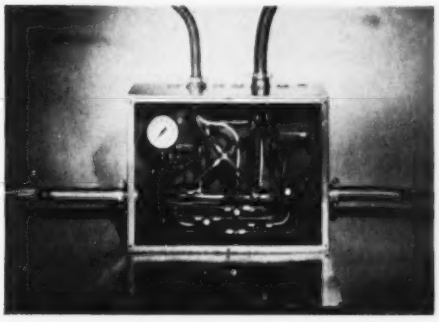


remains the same throughout the length of the cable.

The tubes usually are copper, but aluminum tubes can be used for special purposes. For unusually corrosive situations, a plastic outer sheath can be applied. As many as 19 tubes, ¼" OD, can be cabled, and supplied in lengths up to 1,000 ft.

Showing the construction of Crescent Armored Multitube, made by Crescent Insulated Wire and Cable Co., Trenton 5, N. J., which will supply further information on request.

Since the tubes carry not electricity but air, nitrogen, helium, or a fluid, they are especially attractive in potentially explosive locations, as in refineries and chemical plants. Utilities are also turning decisively to this new cable, while automatic process control (automation) is a rising application.



Revere, as a supplier of tube for this purpose, calls this cabled tube development to your attention as a matter of general and perhaps specific interest. See Revere for copper, aluminum and brass tube and pipe, electric welded steel tube, and lockseam tube. Call the nearest Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

trict sales managers appointed were W. D. DICKERSON, Detroit, Mich., and H. C. SMITH, St. Louis, Mo. For the coated abrasive lines, the following district sales managers were named: CARL L. ADELMAN, Middle Atlantic district; F. M. MANSBERRY, both Cleveland, Ohio, and Pittsburgh, Pa., districts; O. P. QUIST, Chicago, Ill., district; and J. G. KHOURY, sales manager for coated product lines in the Detroit district.

FREDERICK E. MUNSCHAUER, JR., works manager of the Niagara Machine & Tool Works, Buffalo, N. Y.,

Frederick E. Munschauer, Jr., new vice-president of the Niagara Machine & Tool Works

has been elected vice-president in charge of manufacturing and industrial relations. Along with his new responsibilities, Mr. Munschauer will continue as works manager, the position he has held since 1946. He is also a director of the company.

BOROLITE CORPORATION, Niagara Falls, N. Y., a concern recently formed by Firth Sterling, Inc., American Electro Metal Corporation, and The Carborundum Company, has now announced its officers and directors: GENERAL CLINTON F. ROBINSON, president of The Carborundum Company, was named Borolite president and a director; and KENNETH D. MANN, president of Firth Sterling, Inc., and DR. PAUL SCHWARZKOPF, president of American Electro Metal Corporation, were elected vice-presidents and directors. Other directors are as follows: FRANK W. GLASER, vice-president of American Electro Metal Corporation; EDWIN R. BRODEN, executive vice-president of Carborundum; H. C. MARTIN, vice-president, research, Carborundum; and EDWIN B. FORSE, vice-president, Carborundum. The new concern is engaged in the research, manufacture, and sales of borides, carbides, and aluminide products.

EUGENE F. ANDERSON has been named district manager of the New York-New England territory of the Pittsburgh Crucible Division, Crucible Steel Company of America, Pittsburgh, Pa. He replaces W. E. BURLINGAME, who is retiring from this post. Mr. Anderson will have his headquarters in the company's New York City office, and will supervise the sale of constructional alloy steels produced at the Midland, Pa., works. Mr. Burlingame, who has been with the company since 1916, will now, however, handle special assignments.

BEHR-MANNING CORPORATION, of Troy, N. Y., subsidiary of Norton Co., Worcester, Mass., announces the election of two vice-presidents: LEON E. HOOGSTOEL, technical director since 1945; and EDWIN C. EVANS, director of manufacturing. ELMER C. SCHACHT was re-elected president of the corporation at the annual board of directors meeting, this being his fifth term as president of the abrasives firm.

BRUNO D. HENDRICKSON has been named abrasive engineer in charge of the western New York territory by the Norton Co., Worcester, Mass. He replaces EDWARD LALOR, who resigned to go with the Oliver Abrasive & Tool Co., Inc., Buffalo, N. Y., a Norton distributor. Mr. Hendrickson has been an engineer in the sales engineering department since 1945, but with Norton since 1929.

HAROLD C. SPROULE has been appointed district sales engineer in Michigan, Wisconsin, and northern Illinois, Indiana, and Ohio by Hydropress, Inc., and its Loewy Rolling Mill Division, New York City. Mr. Sproule, who succeeds ROLAND HIGGINS, will have his headquarters at Chicago and Detroit.

JOHN VOLKERT METAL STAMPINGS, INC., Queens Village, N. Y., has added 12,000 square feet of floor space to its plant, which is devoted to the manufacture of precision stampings and assemblies for the electronics industry.

KENNETH SLAWSON has been appointed assistant to the president of the Ford Instrument Co., Division of the Sperry Corporation, Long Island City, N. Y. ROBERT ARMSTRONG has joined the Quality Control Division, becoming assistant to the director.

GRANCO PRODUCTS, INC., Long Island City, N. Y., manufacturers of converters and other products, are adding a new plant to their present one, which will include latest electronic production facilities.

PARRY ENGINEERING CO., 154 Nassau St., New York City, has been appointed representative for Poole flexible shaft couplings made by the POOLE FOUNDRY & MACHINE CO., Baltimore, Md.

HARRINGTON-WILSON-BROWN CO., distributor for the Lodge & Shipley Co., Cincinnati, Ohio, in the New York territory, recently moved from the Chrysler Bldg. to a new office in Mount Vernon, N. Y.

ADAMAS CARBIDE CORPORATION, Kenilworth, N. J., manufacturer of standard carbide tools, tool tips, dies, and wear parts, announces the appointment of the following sales representatives: NELSON R. CHURCH CO., 732 Main St., Pawtucket, R. I., for Massachusetts, Rhode Island, Maine, New Hampshire, and Vermont; and ALLIED CARBIDE PRODUCTS, 1801 Old York Road, Willow Grove, Pa., for eastern Pennsylvania, southern New Jersey, and Delaware.

GLENN J. GIBSON has joined the engineering staff of the Cooper Alloy Foundry Co., Hillside, N. J., and will direct welding research.

H. E. ELLIOTT has been appointed sales manager of the Watson-Stillman Co., Division of H. K. Porter Co., Inc., Roselle, N. J. Mr. Elliott has been associated with Watson-Stillman for the last twenty-five years and has been instrumental in developing many lines of the company's hydraulic presses and equipment. R. W. SCHRECK has been named assistant sales manager, specializing in plastics machinery sales.

H. E. Elliott, new sales manager of the Watson-Stillman Co.

By the use of high electrical voltage Metalmaster has given its user the power and speed to cut the hardest metals man has been able to produce . . . This we call DISINTEGRATION for it actually disintegrates the metal without affecting the hardness.

Metalmaster Disintegrators save thousands of dollars each month for their users through the salvage of workpieces normally going into scrap.

One firm alone through the use of two Metalmasters saves annually over $70,000.00 in just tool and die repair alone.

IMAGINE, for a moment, the potential . . . if you could cut ANY shape hole, ANY size in ANY hardened metal!

IMAGINE, for a moment, the potential . . . if you could cut a CURVED HOLE IN METAL!

IMAGINE, for a moment, the potential . . . if you could save that enormous scrap pile of workpieces with broken taps, drills, reamers, etc. You can do it with Metalmaster . . . in a matter of minutes per part.

IMAGINE, for a moment, the potential . . . of a machine that in many cases saves its initial cost in just one free demonstration in a customer's plant. This is a common occurrence with Metalmaster.

For information relative to the many machines available for your type operation and the many advantages Metalmaster can offer your firm, write today on your company letterhead to:

METALMASTER DIVISION:
CLINTON MACHINE COMPANY
CLINTON, MICHIGAN

Remove Broken Taps fast without distortion
Cut oil holes in hardened gears without annealing
Cut dovetails in hardened dies
Cut any shape hole in cemented carbides

Ohio

EATON MFG. CO., Cleveland, Ohio, has acquired the SPRING PERCH CO., Lackawanna, N. Y., producer of chassis springs. F. I. GOODRICH, general manager of Eaton's Spring Division at Detroit, Mich., will be president of the newly acquired company, which will be operated as a subsidiary; E. H. LINDEMAN, manager of the Leaf Spring Department, will be vice-president, and J. E. FAWCETT, resident manager. This acquisition is aimed to take care of future potential requirements that cannot be handled by the Spring Division, which manufactures coil and leaf chassis springs permitting Eaton to better serve industry.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces the formation of a Machine Tool Division, which will be the largest of the three broad divisions of the company —the other two being Machinery and Products. SWAN E. BERGSTROM, vice-president and director of the company, was named manager of the new Division, which is devoted to standard and special machine tools; he will be responsible for all activities, including engineering, manufacturing, and selling. L. F. NENNINGER, formerly works manager, will be Mr. Bergstrom's assistant. This Machine Tool Division will include a new Special Machine Tool Division with CARL STUGARD, formerly manager of the Chicago office, as manager. ED RIVOIRA was promoted to manager of special machine tool engineering and AL DALL was made manager of standard machine tool engineering and development. A. T. BLACKBURN was promoted to works manager. He was formerly general superintendent, FRED MILLER now being named to this post. Appointments in the Machinery Division, the second of the broad divisions mentioned—which includes Flamatic and Hydroform machines, contact machinery, and allied equipment—were also announced as follows: E. D. VANCIL, manager of engineering, becomes manager of the Division; and D. M. STRAUCHEN, formerly manager of this Division, becomes consultant, on extended service.

NATIONAL ACME CO., Cleveland, Ohio, manufacturer of Acme-Gridley multiple- and single-spindle bar and chucking automatics, announces that it has been appointed sales representative in the United States for B. S. A. single-spindle automatic screw machines. This line of automatics for all classes of bar machine work is built by B. S. A. Tools, Ltd., Birmingham, England.

ROWE METHODS, INC., Cleveland, Ohio, manufacturers of hydraulic adjustable loading ramps, have been appointed distributors in northeastern Ohio by the MULT-A-FRAME DIVISION, AINSWORTH MFG. CORPORATION, Detroit, Mich., adjustable rack manufacturer. PAUL DUBOIS, assistant chief engineer at Rowe, will direct the new activity, and LAWRENCE COTTON will be his assistant.

JESSE C. DAVIS, director of purchases at the Reliance Electric & Engineering Co., Cleveland, Ohio, since 1948, is retiring after thirty-eight years with the company. C. C. TIPPIT, who was appointed general purchasing agent in 1950, is taking over the administration of the company's purchasing systems and procedures.

HOWARD R. RICHARDS has been elected president and general manager of Industrial Ovens, Inc., Cleveland, Ohio. Other appointments were as follows: SLOANE E. ALLEN, vice-president and treasurer; E. W. BAUMGARDNER, sales manager; and A. V. ALEXEFF, chief engineer.

DONALD B. HUNTTING CO., Cincinnati, Ohio, representative for the S-P MFG. CORPORATION, Cleveland, Ohio, manufacturer of power-operated chucks and air and hydraulic cylinders, has opened an office at 1904 Brown St., Dayton, Ohio. LEE WEBER is in charge.

VAN NORMAN CO., Springfield, Mass., machine tool manufacturer, has appointed a representative in northeastern Ohio—GARCO MACHINERY CO., INC., 21000 St. Clair Ave., Cleveland, Ohio. HAROLD L. GARDNER is president of Garco.

LESTER J. HENDERSON, sales manager of the Aviation Division of the Weatherhead Co., Cleveland, Ohio, will also become sales manager of the new Industrial Division.

EVAN W. MCNEILL has been made vice-president of the Copperweld Steel Co., Pittsburgh, Pa., and will be in charge of the Ohio Seamless Tube Division, Shelby, Ohio.

Pennsylvania and Maryland

DONEGAL MFG. CORPORATION, Marietta, Pa., producer of carbon, low-alloy, and stainless-steel castings, has appointed the following sales representatives: ENGINEERED SPECIALTIES CO., 12 N. Main St., Wallingford, Conn.; BYRNE & DERSOFI, INC., 50 Church St., New York City; E. F. FREY, 1025 Mason Ave., Drexel Hill, Pa.; CHESTER A. LAPP, 1404

(Left to Right) Swan E. Bergstrom, manager of the new Machine Tool Division of the Cincinnati Milling Machine Co.; C. F. Stugard, manager of the Special Machine Tool Division in the newly formed Division; and E. D. Vancil, manager of the Machinery Division

HERE'S WHY and WHEN

Four of the complete line of Hannifin lever-type Air-Operated Presses that include over 30 basic models in capacities up to 18 tons.

WE RECOMMEND

HANNIFIN AIR PRESSES

. . . ***for Production Operations*** involving assembly, marking, staking, riveting or punching of small parts. Hannifin ½ and 1-ton air presses are fast, safe and economical . . . in both initial cost and operating cost.

. . . ***for Bigger Pressing Operations*** where infrequent use would not warrant the purchase of a hydraulic press. Hannifin lever type air presses are low in first cost . . . assure efficient, uniform work . . . are far more economical to operate than out-moded manual presses.

Select the press you need from the complete Hannifin line of air presses. All operate off ordinary shop air supply. There are over 30 basic models from which to choose, many for either bench or floor mounting. Capacities range from ½-ton to 18 tons . . . ram strokes up to 15 inches . . . daylight to 46 inches . . . reach to 12 inches.

Hannifin Series M ½ and 1-ton Air Presses. Supplied with or without electric valves for push button operation.

Hannifin Series A ½ and 1-ton Air Presses. Notice these have adjustable gap.

WRITE FOR BULLETINS 250, 251 and 252

Hannifin Representatives Are at Your Service in These Leading Industrial Centers

Atlanta, Buffalo, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Houston, Los Angeles, Milwaukee, Minneapolis, Moline, New Orleans, New York, Philadelphia, Pittsburgh, Richmond, Va.; Rochester, N. Y.; St. Louis; Seattle; South Bend, Ind.; Washington, D. C.; Worcester, Mass. In Canada: TEM Sales Company Limited, Toronto and Windsor.

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Hydraulic Presses • Pneumatic Presses • Hydraulic Riveters
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Please send me Bulletins 250, 251 and 252 on Hannifin Air Presses.

Name.....

Position.....

Company.....

Address.....

City.....*State*.....

For more information on products advertised, use Inquiry Card, page 247

E. Ninth St., Cleveland, Ohio; and JOHN E. MULLEN, JR., and JOHN E. MULLEN, SR., 1120 G. Daniel Baldwin Bldg., Erie, Pa.

ALBERT E. BOOT is joining Firth Sterling, Inc., Pittsburgh, Pa., having been appointed carbide service engineer in the Mideastern district. Mr. Boot was formerly with the Wendt-Sonis Co. Also announced was the promotion of ROBERT F. FRAZURE from steel supervisor to assistant district manager in Firth Sterling's Chicago, Ill., district. Mr. Frazure joined the company last year.

STERLING ABRASIVES DIVISION of the CLEVELAND QUARRIES CO., Tiffin, Ohio, has opened a warehouse and sales office at 5801 Rising Sun Ave., Philadelphia, Pa. JOHN A. BAKER, an engineer for the Division in the Philadelphia area, will be district manager. HAROLD A. SKEEN has been appointed sales engineer in the Philadelphia territory.

LEBANON STEEL FOUNDRY, Lebanon, Pa., announces the following appointments: HAROLD C. TEMPLETON, assistant metallurgist for the past year, is being promoted to chief metallurgist; RAY W. PATRIDGE is joining the company as service manager; and ROY W. DAUB, who was in the planning department, is being made chief planning engineer.

KENNAMETAL INC., Latrobe, Pa., announces the appointment of the following representatives: WARREN EISENBERG in the St. Louis, Mo., district; RAYMOND GUENTHER in the Southern district; and ROBERT WELCH, in the New England district.

MONARCH MACHINE TOOL CO., Sidney, Ohio, lathe manufacturer, announces that its Pittsburgh district office, located at 512 Empire Bldg. for the last seventeen years, has moved to 962 Greentree Road, Pittsburgh, Pa.

ALFRED J. PORTER, manager of the Bridgeport, Conn., branch of the Heppenstall Co., Pittsburgh, Pa., steel forgings manufacturer, has been elected vice-president of the company.

ALBERT A. BAKER, plant superintendent of the J. A. Zurn Mfg. Co., Erie, Pa., has been appointed executive assistant. JOHN L. DERBY has joined the company as plant manager.

KOPPERS CO., INC., Pittsburgh, Pa., announces the construction of a mechanical development laboratory for the Metal Products Division. The laboratory will be located at the South Baltimore, Md., plant, which is operated by the Division.

BLACK & DECKER MFG. CO., Towson, Md., maker of portable electric tools, announces that operations have begun in the new addition to the Hampstead, Md., branch plant. This addition, covering 126,800 square feet, doubles the size of the original Hampstead plant.

West Virginia, Georgia, and Kentucky

AETNA BALL & ROLLER BEARING CO. and the PARKERSBURG RIG & REEL CO. have merged, and will be known as the Parkersburg-Aetna Corporation, Parkersburg, W. Va. A. SIDNEY KNOWLES, who was chairman and president of the Parkersburg Rig & Reel Co., has been elected chairman of the board of the new corporation, while WILLIAM A. WOOD, Aetna president and treasurer, has been elected to the same offices. The two concerns will be conducted as divisions and known as the Aetna Ball & Roller Bearing Co., a division of Parkersburg-Aetna Corporation, and the Parkersburg Rig & Reel Co., a division of the Parkersburg-Aetna Corporation. Vice-presidents are: W. V. RATHBONE, J. J. ROZNER, and A. G. EVANS-LOMBE.

GEORGE D. COCKCROFT has been promoted to the position of assistant sales manager of coated abrasives and related products in the Atlanta, Ga., branch of the Minnesota Mining & Mfg. Co., St. Paul, Minn. Mr. Cockcroft joined the organization in 1942, and was on the coated abrasives and related products sales force in the High Point, N. C., territory at the time of his promotion.

CHARLES C. SMITH has joined the Roll Forming Corporation, Shelbyville, Ky., as manager of operations. Mr. Smith was formerly superintendent of manufacturing for the General Electric Co. in Louisville, Ky.

Canada and Mexico

B. C. AMES CO., Waltham, Mass., manufacturer of micrometer dial indicators and gages, announces the appointment of a new representative —J. B. MORRISON MACHINERY CO., LTD., 45 Oriole Parkway, Toronto, Canada.

LINDBERG ENGINEERING CO., Chicago, Ill., announces the formation of EFCO-LINDBERG, LTD., whose headquarters will be 544 Inspector St., Montreal, Canada. F. W. WILSON will be president and A. W. SMITH, manager.

TIMKEN ROLLER BEARING CO., Canton, Ohio, has formed a Mexican sales organization to be known as TIMKEN ROLLER BEARING DE MEXICO, and located in Mexico City. A. E. PORTER, who has represented the company in Mexico for several years, has been appointed manager of the new company. Timken tapered roller bearings and removable rock bits will be maintained in stock to service the Mexican market.

Coming Events

MARCH 24-26—Sixteenth Annual AMERICAN POWER CONFERENCE to be held at the Hotel Sherman, Chicago, Ill. Conference secretary, Edwin R. Whitehead, American Power Conference, Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

APRIL 26-28—1954 Metal Powder Show and Tenth Annual Meeting sponsored by the METAL POWDER ASSOCIATION, to be held at the Drake Hotel, Chicago, Ill. For further information, write to the Association, 420 Lexington Ave., New York 17, N. Y.

APRIL 26-30—Tenth Biennial Industrial Exposition of the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at Convention Center in Philadelphia, Pa. Executive secretary, Harry E. Conrad, 10700 Puritan Ave., Detroit 21, Mich.

MAY 4-7—National spring technical meeting of the AMERICAN WELDING SOCIETY to be held at the Hotel Statler, Buffalo, N. Y., in conjunction with the Second Welding and Allied Industry Exposition at the Buffalo Memorial Auditorium. National secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

MAY 17-20—SECOND BASIC MATERIALS EXPOSITION AND CONFERENCE to be held at the International Amphitheatre, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 31-JUNE 11—Seventh CANADIAN INTERNATIONAL TRADE FAIR to be held at Exhibition Park, Toronto, Ontario, Canada. For further information, write to C. C. Hoffman, Trade Fair Administrator.

JUNE 6-9—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION to be held at the Homestead, Hot Springs, Va. Executive secretary, John C. Sears, Empire Bldg., Pittsburgh 22, Pa.

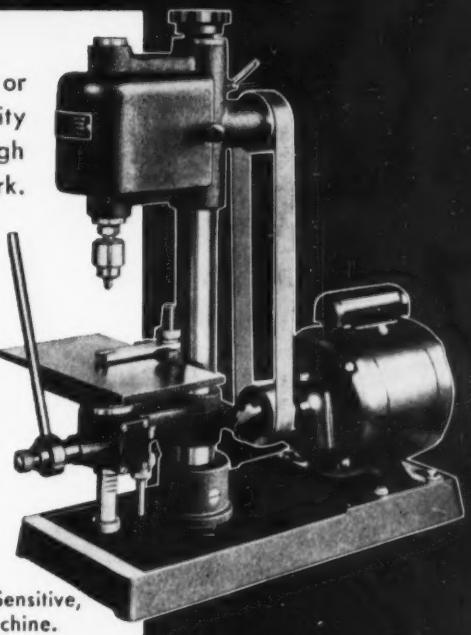
JUNE 7-10—Sixth National Plastics Exposition sponsored by the SOCIETY OF THE PLASTICS INDUSTRY, INC., at the Public Auditorium in Cleveland, Ohio. Chairman, P. H. Grunnagle, Society of the Plastics Industry, Inc., 67 W. 44th St., New York 18, N. Y.

YOU CAN DRILL OR TAP TINY, PRECISION HOLES . . . ON A *PRODUCTION* BASIS . . . WITH *MINIMUM* SCRAP AND *MINIMUM* TAP AND DRILL BREAKAGE

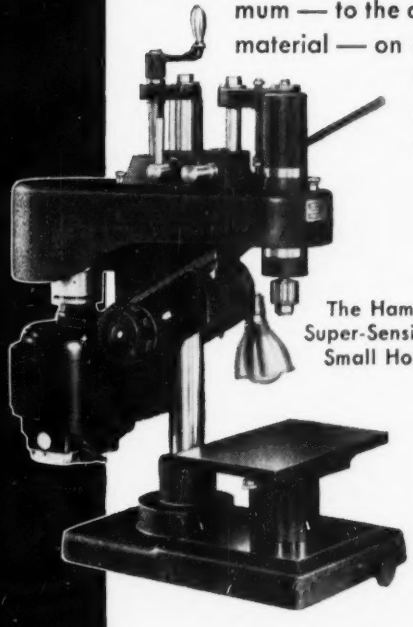
BUT YOU MUST FIT THE TOOL TO THE JOB

When your job calls for tiny, precision holes, drilled or tapped, rely on this; such holes can be produced in quantity and within allowed tolerances only on super sensitive, high precision machines **designed and built** for this class of work.

HAMILTON Drilling Machines and Tapping Machines are super sensitive and extra accurate; **designed and built** for the production of tiny, precision holes. The drilling machines produce holes **up to** 0.3125" maximum — to the center of 10" — in **any** drillable material — on fast production schedules. The tapping machine is designed to use the smallest and finest tap and **up to** 10-32 inclusive.



The HAMILTON® Super-Sensitive, Small Hole Tapping Machine.



The Hamilton VARIMATIC® Super-Sensitive, Variable Speed, Small Hole Drilling Machine.

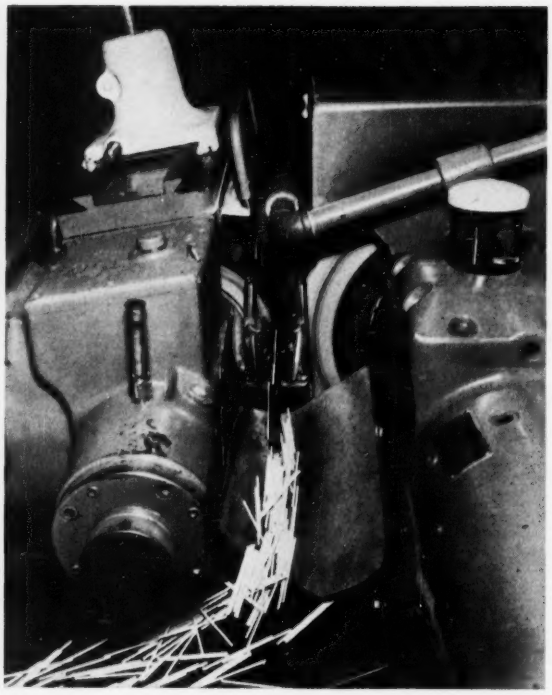
Multiple spindles also . . .

Acquaint yourself with Hamilton Super Sensitive, Small Hole Drilling and Tapping Machines and be ready for the challenge ahead. Ask for our FREE Bulletin DT-5308.

THE Hamilton TOOL COMPANY

[illegible] NINTH STREET • HAMILTON • OHIO • U • S • A

Using a square indexable tungsten-carbide insert in boring alloy-iron truck brake drums



Centerless grinding of ceramic parts with a diamond wheel that cost over $25,000

Forty-Seven Miles of Lineal Cutting Per Grind of Carbide Tools

Longer tool life is being obtained in boring truck brake drums by the Capitol Machine Co., Columbus, Ohio, through the use of a clamped, tungsten-carbide tool instead of a brazed carbide tool of conventional type. The brake drums are made from an alloy iron having a hardness of Brinell 210 to 230. The bore is 16.420 inches in diameter and is machined to a length of 7 inches on a Potter & Johnston turret lathe.

Excessive heat developed during cutting, which varies from 1/8 to 1/4 inch in depth due to run-out of the casting, resulted in a production of only five pieces per grind with the conventional type of tools. Now by using a square insert tool of Kennamatic Grade K6 tungsten carbide, held vertically as illustrated, twenty to twenty-five drums are bored with each indexable cutting edge. The back and side-rake angles of the insert were ground to zero.

Since four edges are available on each end of the insert, 160 to 200 pieces are bored per grind of the insert. Approximately twenty regrinds can be made on each tool, giving a total of from 3200 to 4000 drums per insert life.

Aluminum Skyscraper on Film

America's first aluminum skyscraper, the thirty-story Alcoa Building in Pittsburgh, Pa., is the subject of a documentary motion picture recently completed by the Aluminum Co. of America. The 16-millimeter color film, "Aluminum on the Skyline," has a running time of twenty-eight minutes. Unique features in construction are pointed out—the lightweight steel frame; the vertically pivoted reversible aluminum windows; the radiant-heating aluminum ceiling; and the aluminum plumbing, wiring, hardware, and ornamental trim.

Primarily directed to architects and builders, the film is also of general interest to business, civic, and educational groups. Prints may be obtained by writing to Alcoa's Motion Picture Department, 722 Alcoa Bldg., Pittsburgh.

One Grinding Wheel Worth $25,000

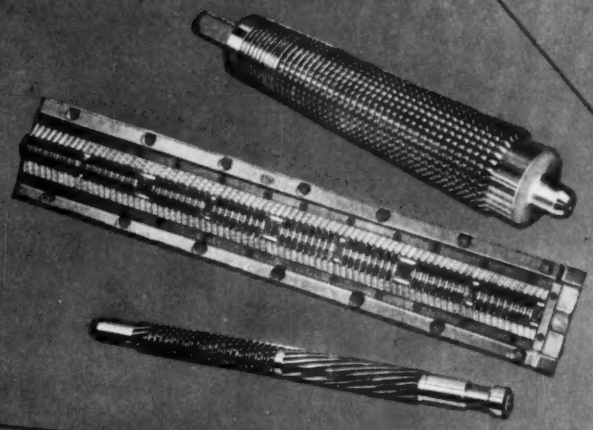
The grinding wheel used by the American Lava Corporation, Chattanooga, Tenn., for the precision centerless grinding of ceramic parts, has a list value of $25,408. This 20-inch diameter, 6-inch face wheel was made by the Diamond Products Division of the Norton Co. It has diamonds to a depth of 1/8 inch. The wheel is the most expensive ever made by Norton.

In spite of the initial cost, the user considers this wheel most economical because it permits the precision centerless grinding of extremely hard ceramics within a tolerance of 0.0001 inch at high rates of production and low grinding costs. Shop records indicate that the life of this wheel will be more than three years based on twenty-four-hour use, five days a week. The ceramic parts ground with the wheel are used as thread guides by the textile trade and as sleeves and coil forms in electronic applications.

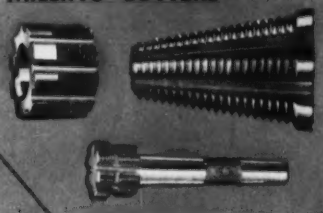
* * *

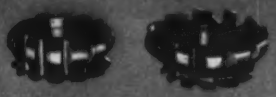
Great Britain exported twice as many passenger cars in 1952 as did the United States.

BROACHES

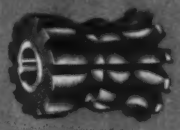


GROUND MULTIPLE THREAD MILLING CUTTERS





FORM-RELIEVED MILLING CUTTERS



"Production-Proved" CUTTING TOOLS BY Continental

The cutting tools supplied to industry by Continental are *Production-Proved Tools*. Here's why:

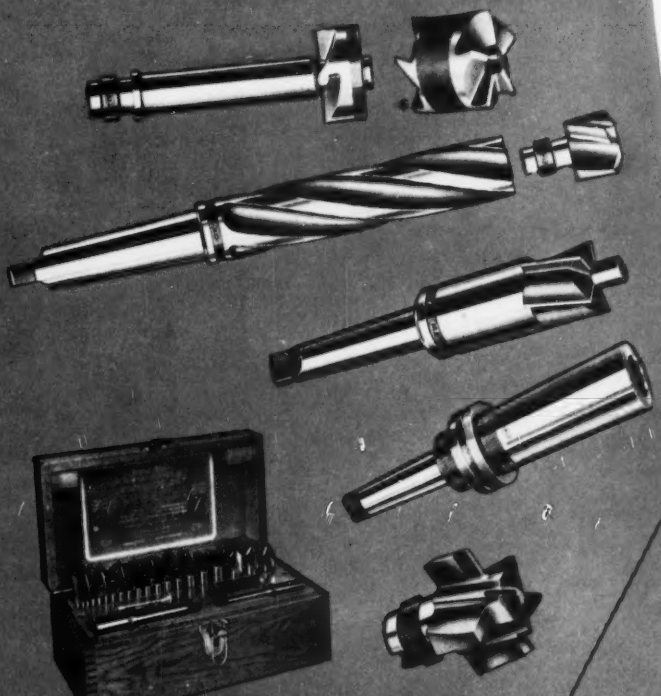
Continental is an Ex-Cell-O subsidiary. As such, it can try out new tool designs, new methods, in Ex-Cell-O's big parts production shops. There could be no finer "proving ground."

Thus, Continental offers *Production-Proved Cutting Tools*. They are time-and-cost savers.

Call in your Ex-Cell-O representative or contact Continental in Detroit today for information about them.

FACE MILLS

CONTINENTAL DRIVE TOOLS



CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation, Detroit 32, Mich.

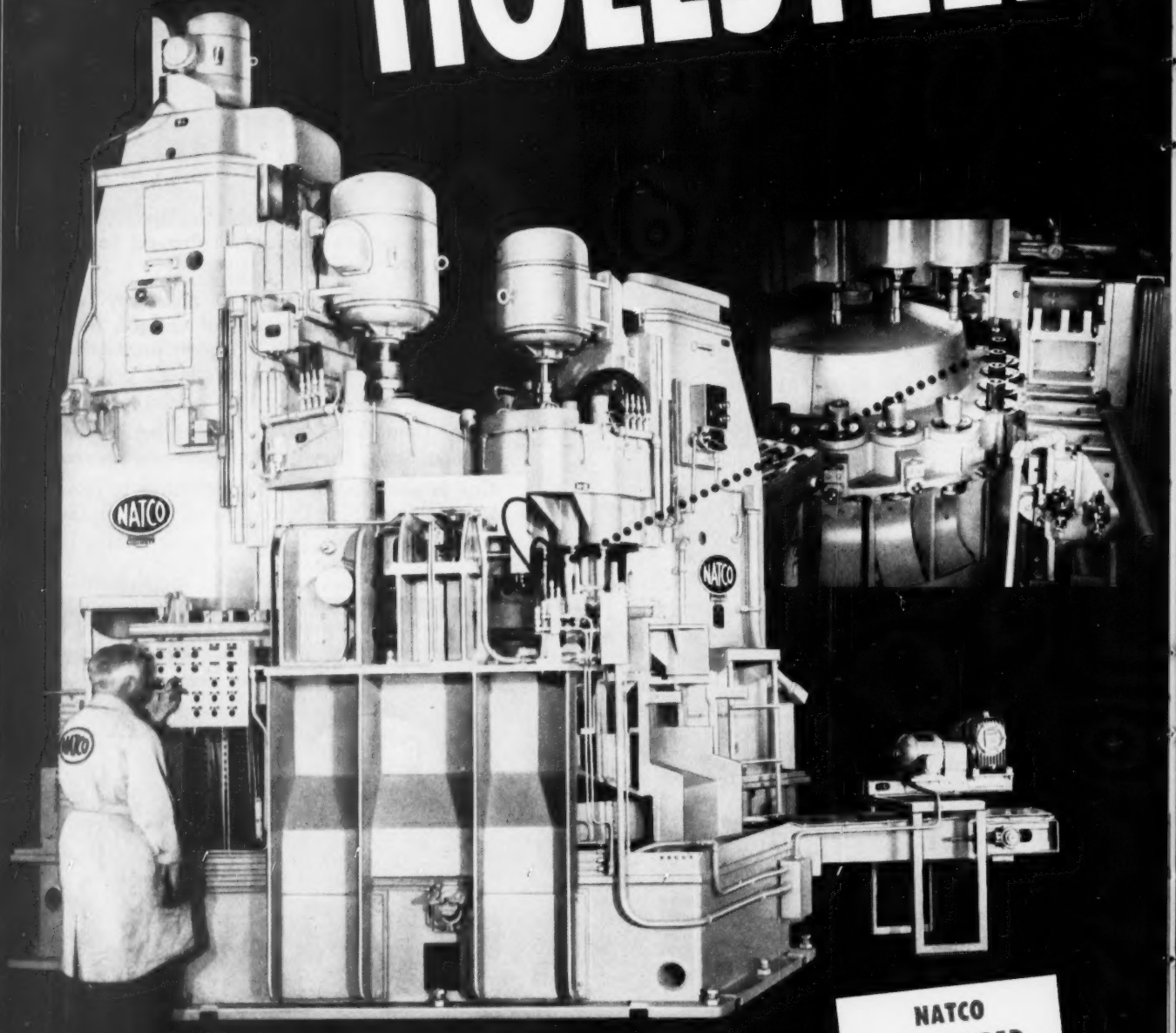
CTW

SINGLE POINT TOOLS

FORM TOOLS

53-47

NEW NATCO HOLESTEEL



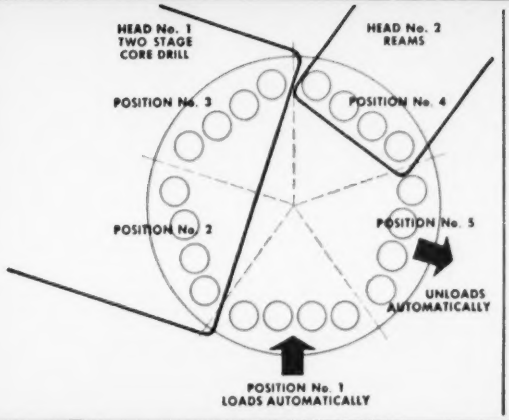
. . . THIS IS ANOTHER MACHINE

NATCO ENGINEERED
for quality and quantity production

CUTS TRACK LINK BUSHING COSTS!

AUTOMATICALLY CORE DRILLS and REAMS SIX DIFFERENT SIZES UP TO...

400 PARTS per HOUR!



FIVE POSITION INDEXING TABLE WITH 20 CHUCKS, AUTOMATIC LOAD and UNLOAD

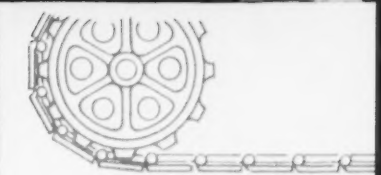
POSITION No. 1
Automatically loads four bushings . . .

POSITION No. 2
Core drills halfway through . . .

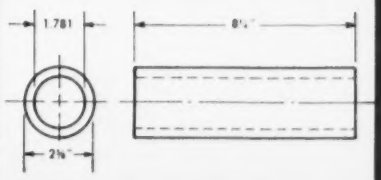
POSITION No. 3
Core drills through . . .

POSITION No. 4
Reams through to size . . .

POSITION No. 5
Automatically unloads four bushings.



TRACK LINK BUSHING



This new NATCO HOLESTEEL automatic indexing machine core drills and reams six different size bushings ranging from 5" to 8¼" in length, 2⅛" to 2⅝" O.D. and 1.4375" to 1.781" I.D. at the rate of from 270 to 400 per hour estimated gross production. The production depends upon the size bushing being run. Estimated gross production is based on 85% of maximum capacity. The stock from which these parts are made is seamless steel tubing and approximately 1/16" of stock is removed in this core drilling and reaming operation.

Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping.

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

CHICAGO, 2009 Engineering Bldg. • DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon

New Idea . . .

IN TESTING CASTINGS FOR LEAKS

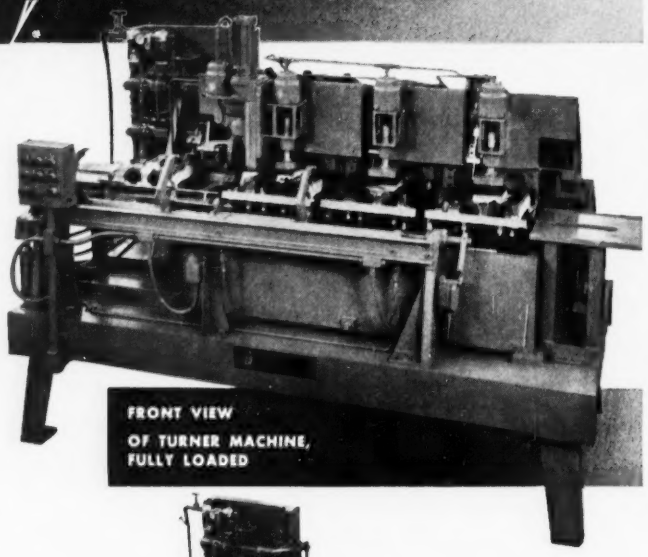
TURNER MACHINE PRESSURE TESTS AND ISOLATES THE LEAK AUTOMATICALLY!

Designed to leak-test manifold castings, or any other type of leak-proof castings.

The Turner machine illustrated checks simultaneously at separate stations:

1. **Water connections and heating cavity.**
2. **Lower sections of intake cavities.**
3. **Upper section of intake cavity.**

And, any leak is isolated automatically! That's the big advantage over pressure gauge testers!



FRONT VIEW
OF TURNER MACHINE, FULLY LOADED

DOWN VIEW
SHOWS MANIFOLDS SUBMERGED IN 90 GAL. TANK

REAR VIEW
SHOWING GAUGE. AIR IS INTRODUCED AT 40 LBS. PRESSURE

Specially designed to save manpower as well as accurately test for casting leaks, the Turner machine performs each step automatically. The manifolds are picked up from the automation station, brought into loading position, then transferred to each testing station. When parts are in position in the fixtures, the machine clamps them into place and seals all openings. By means of air cylinders, the parts are then dropped into a 90 gal. water tank, deep enough to completely cover the parts. Remaining submerged for about 15 seconds which allows the operator ample time to detect and mark any leak. The head then automatically comes back to its original position and the transfer mechanism picks up another part . . . at the same time ejecting the checked part onto the automation system.

More accurate, and even more economical than other methods of checking casting leaks, the new Turner machine can be adapted to any type or size of similar leak-testing application. It's designed to help save manpower, inspection time and floor space . . . while increasing production!

If you have a production assembly or inspection problem where you can use to advantage a special purpose machine, write today describing your problem. After our engineering department analyzes it, our field engineer will discuss it with you.

TURNER BROS. INC.
2625 HILTON ROAD
FERNDALE 20, MICHIGAN

DESIGNERS and BUILDERS of:
- SPECIAL MACHINES
- JIGS and FIXTURES

For more information on products advertised, use Inquiry Card, page 247

Black & Decker
Cases for Comment

CONSTRUCTION

(Case History 4881)
Workers on heavy construction project report B&D Portable Electric Grinders... stand up very well, very handy to use, not awkward nor heavy, give no vibration.

MAINTENANCE

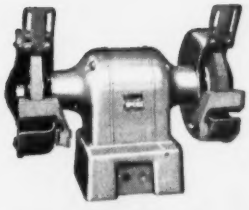
(Case History 2117)
B&D Bench Grinders often give more than 10 years constant use...not losing a minute for repairs.

PRODUCTION

(Case History 4092)
This B&D Die Grinder cuts grinding time ⅓ ...does twice the work.

The McDonald Company of Boston, Mass. manufactures galvanized iron and stainless steel equipment. B&D Tools used for approx. 8 years. In addition to Die Grinder they use B&D Shears, Holguns* and Portable Electric Grinders. The Black & Decker Die Grinders have cut the job time by at least ⅓. Company reports amount of work doubled.

Joe, plant management says that B+D Tools "can take it"
Top management says, "could use more of them"



BENCH GRINDERS
Heavy-Duty models available in 3 sizes, 6", 8", 10". For the finest tool dressing, grinding, wire brushing, burnishing, buffing.

PORTABLE ELECTRIC GRINDERS
In 3 models, 3", 5", 6". All with husky housings and precision parts. Ideal for any job where grinder must be taken to the work.

DIE GRINDERS
2 models. The No. 8 is powered by a new B&D-built motor. Small, only 2½ lbs . . . compact, diameter only 2⅛". Also available, 3" Die Grinder.

Here's Proof that Black & Decker Power Saves *Time and Trouble*

In countless cases where industry needs power, industry's choice is Black & Decker.

In grinders, drills, saws, hammers, screw drivers, industry finds Black & Decker packs the power to get greater production . . . per machine . . . per man-hour.

Why? Because Black & Decker Power is *custom-built* into every B&D Tool . . . power to perform the job the tool is specially designed to do. B&D Tools are driven by B&D-built motors. Built with precision parts and husky housings (in the most advanced designs) every B&D Portable Electric Tool can be relied upon to give long service with less trouble. Every one is a profit-making production tool. And the facts prove it.

Find out for yourself. Next time the job calls for power, call on Black & Decker to supply it. Call your B&D Distributor for a demonstration. And write for free detailed catalog. Address: THE BLACK & DECKER MFG. CO., 605 Pennsylvania Ave., Towson 4, Md.

See "TOOLS-ELECTRIC"

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker
PORTABLE ELECTRIC TOOLS

* Trade Mark Reg. U. S. Pat. Off.

For...

General-Purpose Sawing

with

High Speed

Accuracy, Economy

Model 4B/M2/E2
Equipped with standard
work track
(Optional Equipment).

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

MARVEL No. 4B

HIGH SPEED HACK SAW

Exclusive features

1. Horizontal Ball Bearing Saw Frame.
2. Screw Feed—Automatic or Hand Operated.
3. Quick Return Stroke—allows greater number of strokes per minute.
4. Simple Positive Coolant System.
5. Adjustable Stroke—can be shortened for larger capacity.
6. Speed Range—available in 1, 2 or 4 speed models for wider range of work.

Metal Cutting

MARVEL SAWS

Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Avenue • CHICAGO 39, ILL.

For more information on products advertised, use Inquiry Card, page 247

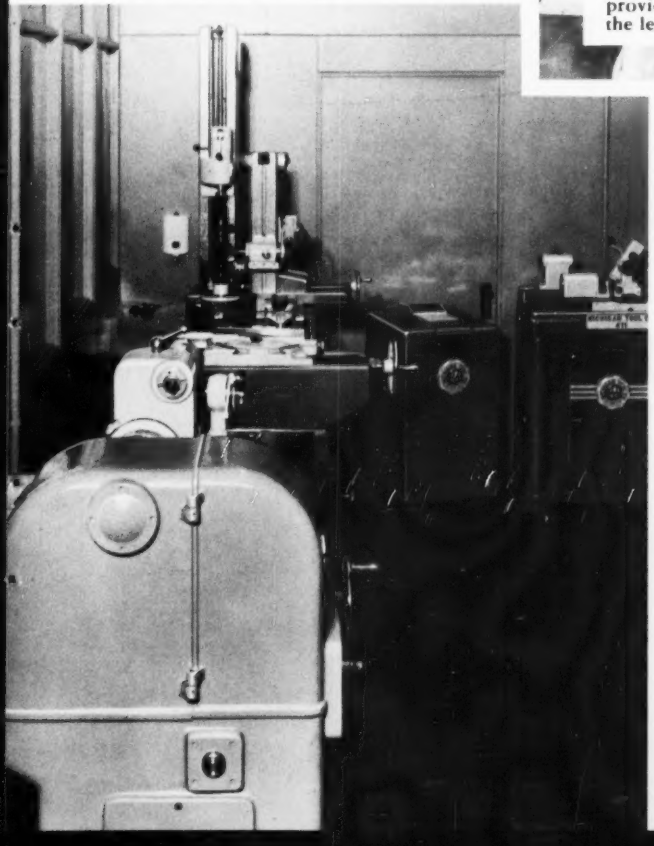
This Month's

GEAR PIX

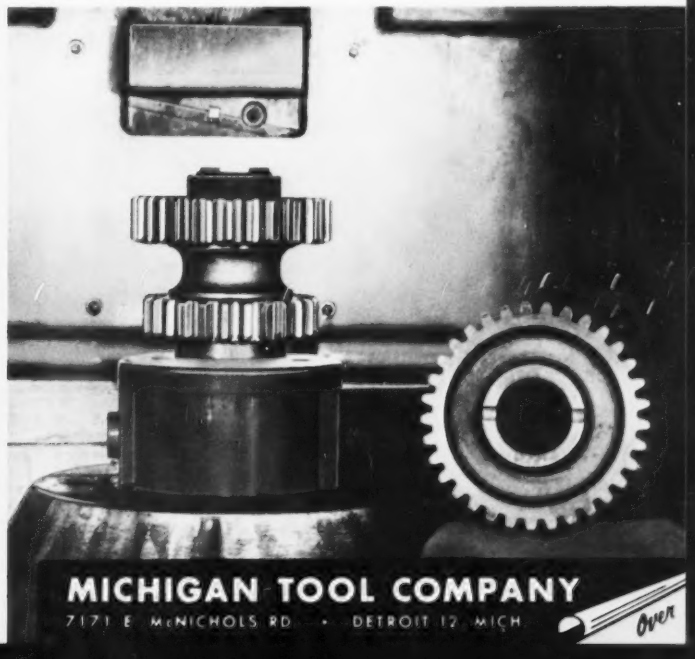
SHAVING—Tractor transmission clusters are shaved automatically on this Michigan 870. Gears are 1.6429" and 2.000" P.D.—23 and 28 tooth. Sizing fixtures, chute loading, and automatic expanding mandrels, plus automatic machine cycle, give an average rate of four per minute for each gear. Changeover requires but a few minutes.

SHAVING—Both helicals on this big marine herringbone gear are shaved at the same time on this Michigan V-120 gear finisher. Michigan "guided" cutters for shaving large wide-face gears provide added accuracy, especially accuracy of the lead.

CHECKING—One corner of a modern gear laboratory in a large automotive plant. Michigan Sine-Line 1205 lead checker is in foreground, Sine-Line 1124 involute checker in corner with Michigan MTR recorder, and Michigan 471 gear checker at right.



CUTTING—Michigan Shear-Speed gear shaper cuts both spur gears on this truck transmission cluster. All teeth on the larger gear (33 teeth, 5.34" diameter, 1⅛" face width) are cut simultaneously in 2.74 minutes.



MICHIGAN TOOL COMPANY

7171 E McNICHOLS RD • DETROIT 12, MICH

Over

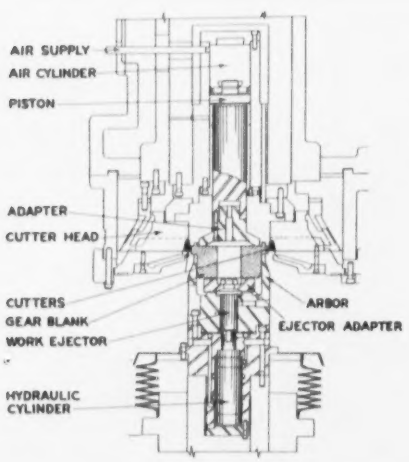
This Month's

GEAR PIX

CUTTING—Shear-Speed gear shaper cuts 125 transmission gears per hour—500 gears between tool sharpenings—floor space 49 sq. ft. as compared to 312 sq. ft. by former methods. Gears are 2.500" P.D. Pitch diameter is held concentric to internal major spline diameter within 0.0025" total indicator reading.

SHAVING—Instrument gears up to 4" diameter are shaved to extreme accuracies at high production rates on this Michigan 861-4B (one of a battery) in an eastern plant. Note magnetic chip separator to insure chip free coolant.

SPEEDING—Speed testing of mating gears in a modern transmission plant will be the job of this battery of seven Michigan model 1126 gear speeders. Machines are standard, fixtures are custom made.



CLAMPING—Automatic pneumatic clamping and manual hydraulic ejection are available on all models of Michigan Shear-Speed gear shapers now. Details are shown in the drawing above.

MICHIGAN TOOL COMPANY

7171 E McNICHOLS RD • DETROIT 12, MICH.

over

THREE BROACH USERS TELL WHY

INDUSTRIAL POWER . . .

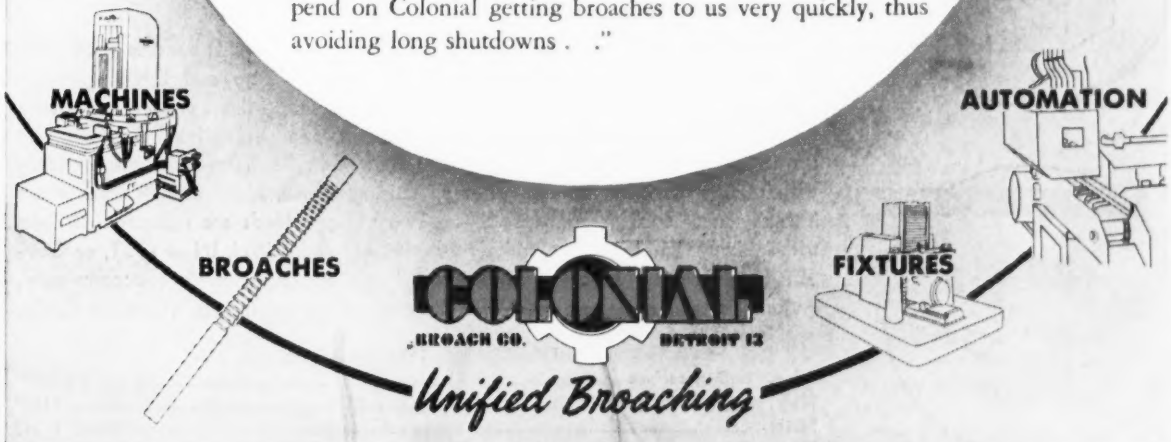
. . . "We like Colonial broaches because of their accuracy, dependability, and service rendered by the company and their representatives . . ."

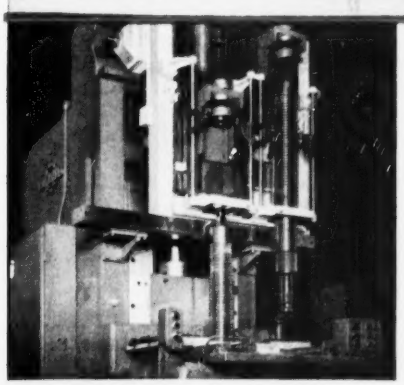
ELECTRONICS . . .

. . . "It has been our experience that Colonial broaches have given us most satisfactory results. Quality, workmanship and tolerances furnished on these broaches are a definite asset to our company . . ."

COAL MINING EQUIPMENT . . .

. . . "We are well satisfied with the performance of Colonial broaches in regard to tool life, low maintenance, and close tolerances, which they must hold. A big factor is that in the event of a rush or a break-down job, we have learned to depend on Colonial getting broaches to us very quickly, thus avoiding long shutdowns . ."



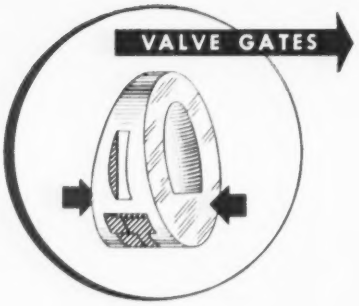


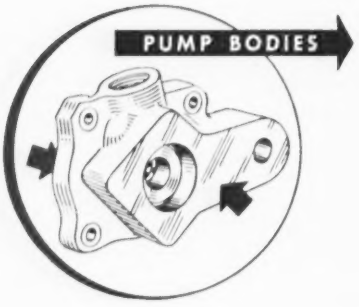
NO BROACH HANDLING - ½ *the Work Handling*

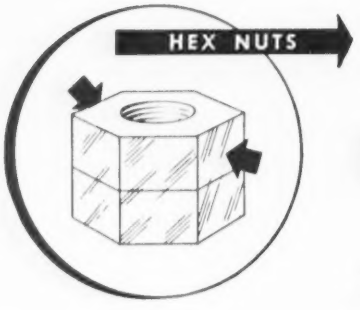
A big gain in efficiency as well as a reduction in cost results when there is no broach handling between passes in the two-step broaching of large parts. The Colonial dual sliding broach handling support handles the two broaches automatically and permits two-pass broaching with only one handling of the work piece.

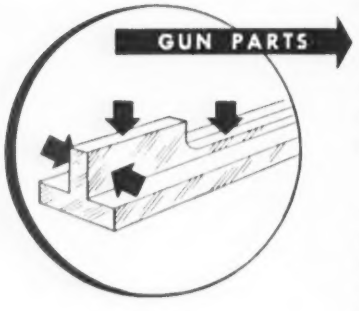
The entire cycle through both broaching passes is automatic on this Colonial 50-ton, 72-inch stroke, pull-down broaching machine.

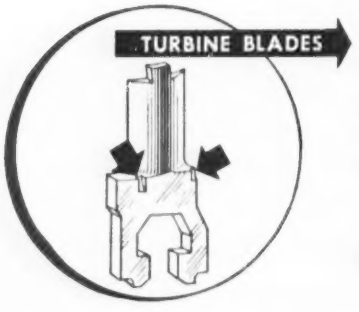
This is a Colonial Unified Broaching Installation.

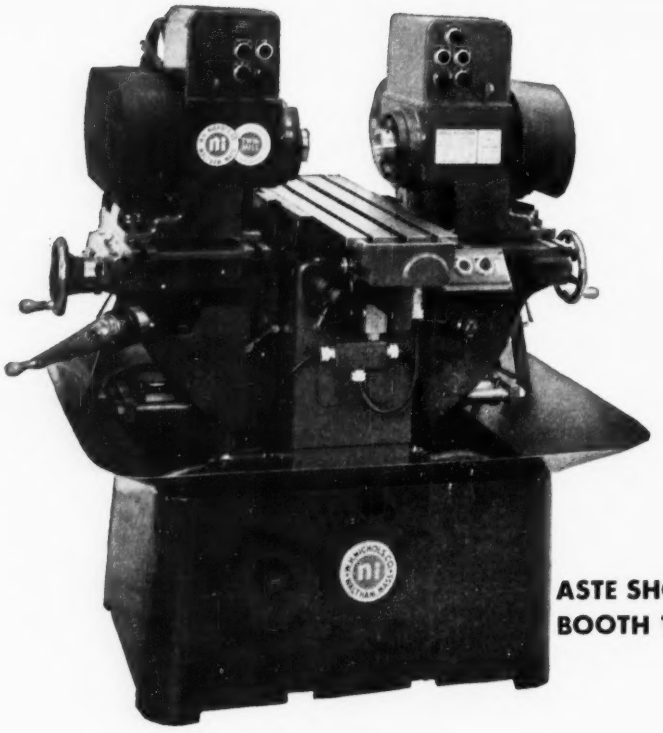












ASTE SHOW
BOOTH 1431

on the NEW *Nichols* TWIN MILL

The TWIN MILL cuts milling costs in half on many jobs. It handles **TWO** milling operations at a time, yet requires but **ONE** fixture and **ONE** operator. Designed for the class of work usually assigned to Hand Millers or light Automatic Production Millers, the Twin Mill's speed, accuracy, and exceptional flexibility add up to increased output at lower cost. **New** Spindle Retraction automatically withdraws cutters at the end of each cutting stroke. **New** Spindle Brakes act instantly after cycle is completed. The Two Milling Heads are independent units with individual motor drives, quickly adjusted UP or DOWN, IN or OUT, or OFF-SET longitudinally. Machine handles short run or long run work economically. Automatic table cycle and entire machine push-button controlled. Write for details.

CONDENSED SPECIFICATIONS

Table, working surface	8⅝"x 30"
Table, travel—cutting stroke	11¾"
Motors	(two) 1 HP
Maximum height center of spindle above table	11¾"
Maximum offset of spindles (horizontal)	8½"
Maximum distance between spindle noses (across table)	16"
Floor space required	64"x56"
Spindle Speeds (16)	from 55 to 2050 R.P.M.

Manufactured by W. H. Nichols Co., 48-U Woerd Ave., Waltham 54, Mass.

Have you seen the new Nichols' movie, "The Miller That Uses Its Head"? It's available for showing in your plant.

Also available are NICHOLS Hand Millers, NICHOLS two-spindle millers with identical or opposed spindles, and with or without pneumatic feed.

Please address inquiries to

NICHOLS-MORRIS CORPORATION 76-E MAMARONECK AVE. WHITE PLAINS, N. Y.

Dealers in Principal Cities

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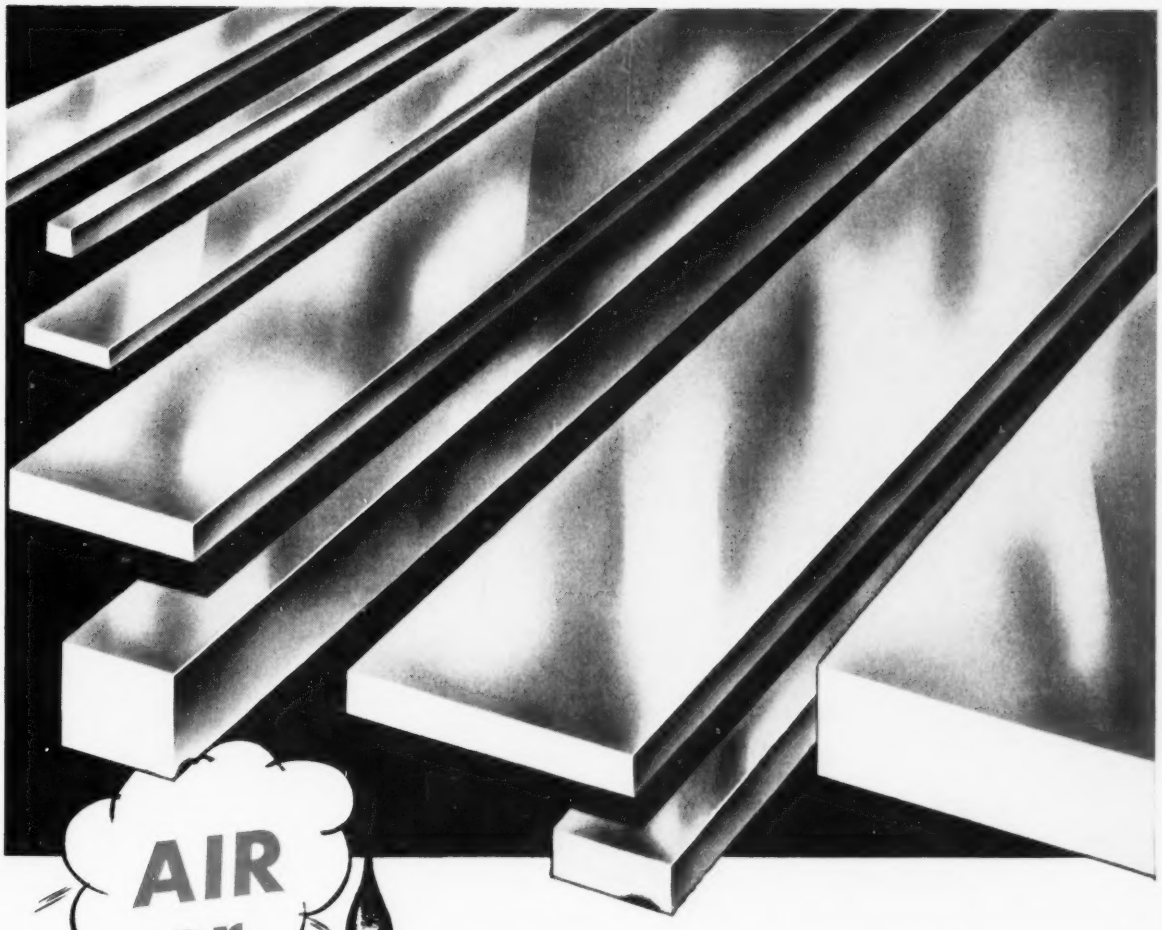


HARDENING?... which DIE STEEL is best for you?

For punches and dies that produce up to 50% more pieces per sharpening — use *Simonds Air Hardening Die Steel.* 5% chrome content makes this non-deforming steel more wear-resistant. Better for punching or cutting silicon or stainless steels, Monel metal, or other abrasive metal. Spheroidize annealed for good machinability, it also has a wide hardening range (1700° to 1800°F). Stock sizes from ½″ to 2″ thick, and 2″ to 10″ wide in 36″ lengths.

For standard die, jig, punch, gage and small tool applications, *Simonds Oil Hardening Flat Ground Die Steel* is a valuable time and money saver. Made of non-deforming molybdenum type die steel, it is uniformly annealed for easy machining and uniform hardening. Due to its wide hardening range (1450° to 1540°F) good results are assured with even the simplest heat treating equipment. Stock sizes available from 1/64″ to 3″ thick and ⅛″ to 14″ wide in 18″ lengths. Heavier sizes also furnished in 36″ lengths.

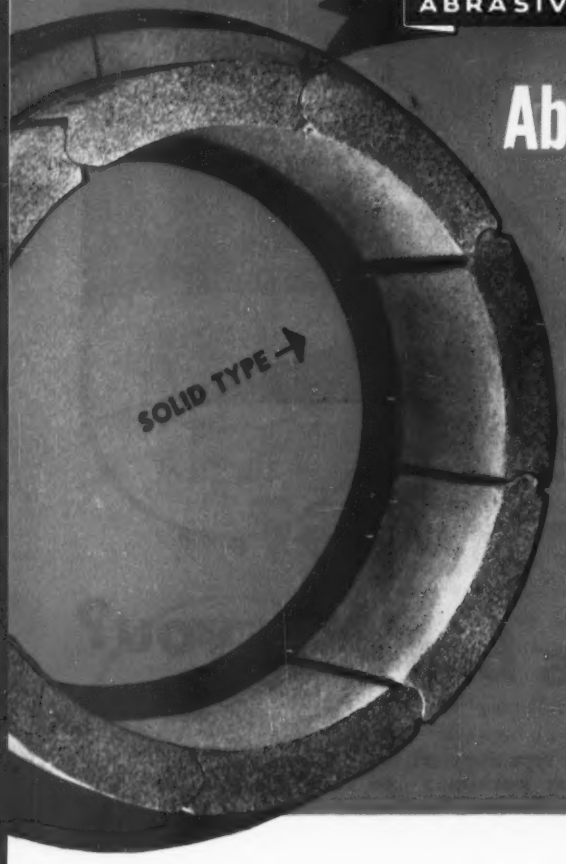
Your Simonds Distributor stocks many sizes of both types . . . individually packaged with simple heat treating instructions. Call him for complete details.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

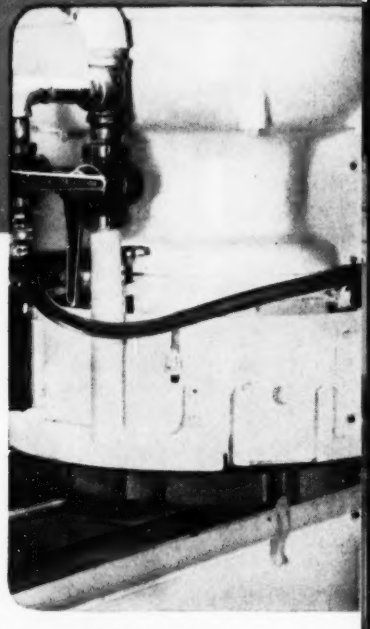
Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon. Canadian Factory in Montreal, Que.
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

any way you look at it...

SIMONDS ABRASIVE CO.



Abrasive Segments mean surface grinding with savings



Less expensive than cylinder wheels. More uniform in grinding characteristics. Easily handled. Quickly mounted. Fast cutting. Compact for less storage. Fit all types of chucks. Gap type for large flat surfaces—solid type for small pieces grouped or chucked together. Write for bulletin ESA-188.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

BRANCH WAREHOUSES: BOSTON, DETROIT, CHICAGO, PORTLAND, SAN FRANCISCO • DISTRIBUTORS IN PRINCIPAL CITIES

DIVISION OF SIMONDS SAW AND STEEL CO., FITCHBURG, MASS. • OTHER SIMONDS COMPANIES: SIMONDS STEEL MILLS, LOCKPORT, N.Y., SIMONDS CANADA SAW CO., LTD., MONTREAL, QUEBEC AND SIMONDS CANADA ABRASIVE CO., LTD., ARVIDA, QUEBEC

new T-J REAMER

CUTS REPLACEMENT COSTS IN HALF!

Just *one shank* to buy for wide range of sizes . . . when you use these new-type T-J Reamers with *interchangeable heads!* Sizes from ½" to 2¾" inclusive, in 1/16" increments . . . spiral flute. Only the *heads* to buy for replacement—this cuts your cost to *less than half!*

Head has tapered hole which insures concentricity and a snug fit on smoothly ground tapered shank. Reamer operates free from binding or sticking, due to cutting portion wearing undersize and creating negative relief. Performance retains all advantages of standard, expensive reamer. Backed by T-J's 38 years of know-how as one of largest manufacturers of die sinking milling cutters.

- **Quick Change of Heads...Save Time!**
- **Easy to change heads for *different metals*... increases efficiency!**
- **Wide range of sizes... spiral flute!**

SEND!

The Tomkins-Johnson Co.
Jackson, Mich.

Please send catalog 153 about the new-type T-J Reamers with interchangeable heads.

Name _____

Company _____

Street _____

City _____ State _____

T-J **TOMKINS-JOHNSON**

RIVITORS . AIR AND HYDRAULIC CYLINDERS . CUTTERS . CLINCHORS

38 YEARS EXPERIENCE

From Sinclair Research Comes

An IMPROVED hydraulic oil

SINCLAIR DURO

4 vital inhibitors assure protection against rust – oxidation – foam

Sinclair DURO Hydraulic and Machine Oil was developed by Sinclair's Research Laboratory, Harvey, Illinois, to meet the requirements and demand for a quality hydraulic oil – an oil which would assure sensitive hydraulic system control and operation.

Sinclair DURO Oils have *unusually high oxidation resistance* to combat corrosive materials, varnish and sludge formation. The inclusion of Sinclair's rust inhibitor *protects metal surfaces* against rusting in systems where frequent shutdown causes moisture condensation. Sinclair's rust inhibitor "plates out" on a metal surface for maximum rust prevention. Moreover, Sinclair DURO Oils have *extremely effective anti-foam characteristics* which prevent foam-promoting air bubbles from remaining in suspension.

These are only some of the reasons why Sinclair DURO Oils permit smoother, full-powered transmission for high productivity. For further information why not call your local Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR

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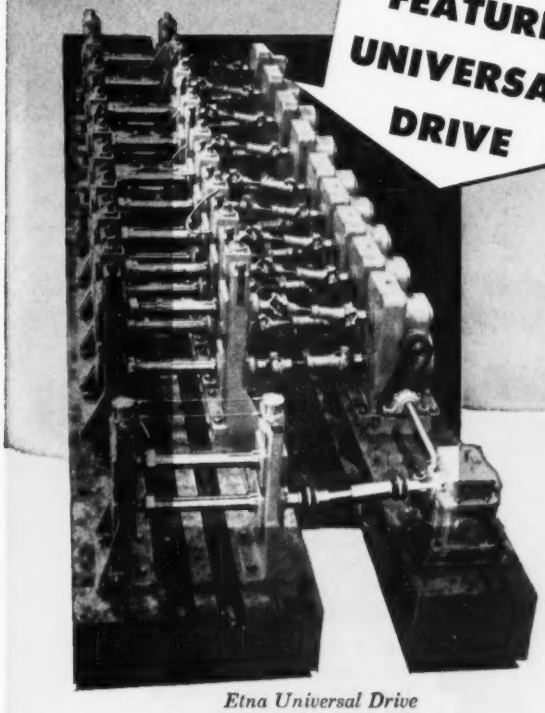
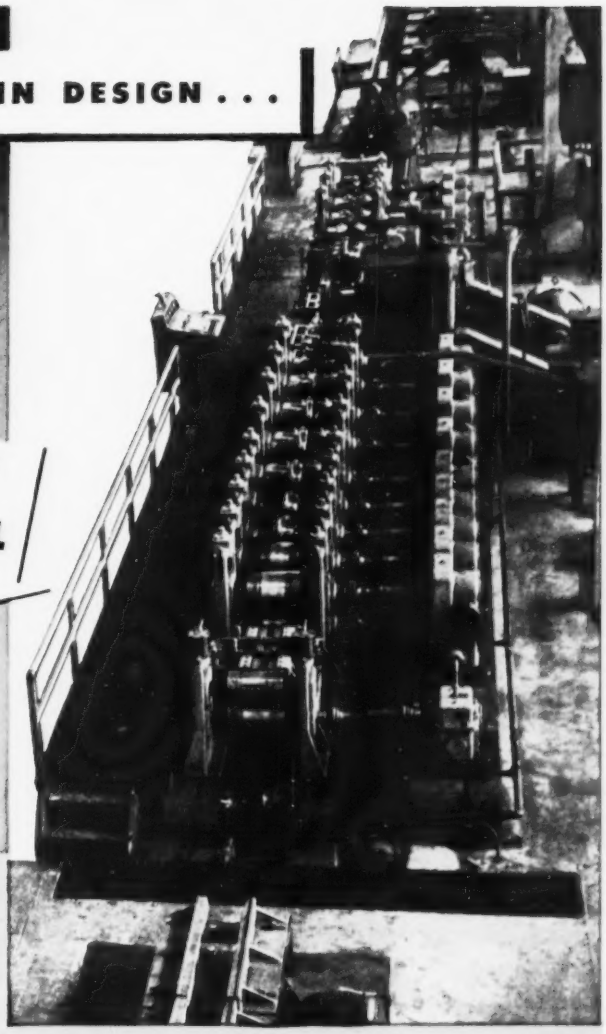
LEADING THE INDUSTRY IN DESIGN . . .

Etna TUBE MILLS

FEATURE UNIVERSAL DRIVE



Etna Universal Drive



You'll notice a trend toward Etna's modern machine design. Etna has sold more Universal Drive Mills than all other manufacturers combined. The Universal Drive provides greater accuracy in the forming of the tube, and allows an easier change from the manufacture of one diameter tube to another.

PERMANENT OIL COOLED TRANSFORMER

For greater efficiency an *Oil Cooled Transformer* is incorporated into the machine. It is a *permanent unit* and *never has to be replaced.* Cooling with oil eliminates the necessity to dry out the transformer after each days work, which is necessary when water is used as a transformer coolant. Etna Mills . . . Built for continuous operation. Write for complete details.

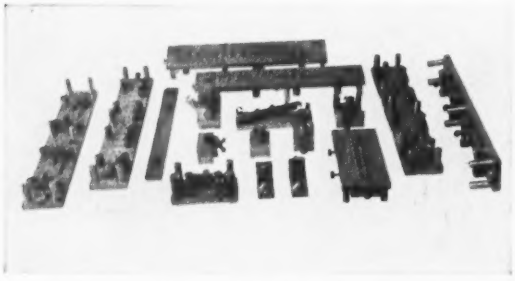
Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

YOU GET *SPEED* PLUS ACCURACY WITH MOORE JIG BORERS

IN THE TOOLROOM

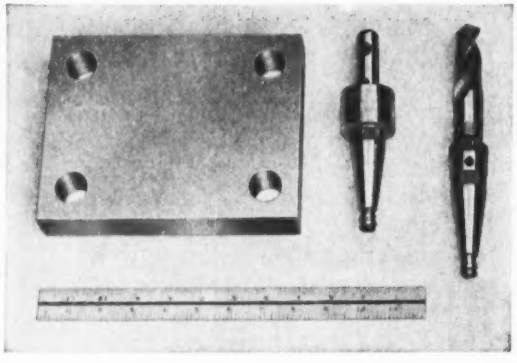
400 holes to "tenths"—5 to 7 minutes each on the No. 1 Moore Jig Borer



Manufacture of this group of drill jigs involves accurately locating, drilling and boring approximately 400 holes. The No. 1 Moore Jig Borer finished them to "tenths" in from five to seven minutes per hole.

ON PRODUCTION

64 holes to ±.0002"—2 minutes each on the No. 2 Moore Jig Borer

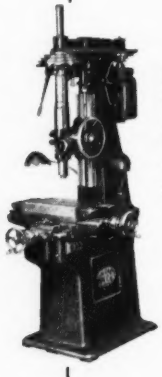


Sixteen pieces like this were located, drilled, bored and checked on a No. 2 Moore Jig Borer with one drill and one carbide bit. The 64 holes were finished in 2 hours and 8 minutes (plus 30 minutes setup) with location and size tolerances ± .0002".

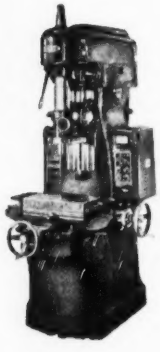
Only a precision machine geared to the high American production standards of ruggedness *and* accuracy can meet these performance requirements. For versatility and speed in spotting, drilling, reaming, boring and checking operations in production as well as tooling, no other moderately-priced machine tool compares with the Moore Jig Borer. And there's no sacrifice of accuracy for speed, since the lead screw measuring system built into each Moore machine permits working to the closest of tolerances.

You'll find that the Moore Jig Borer can pay for itself—*in jig time*. Write today for detailed bulletins.

Moore Special Tool Company, Inc.
734 Union Avenue, Bridgeport 7, Conn.



NO. 1 MOORE JIG BORER
Table working surface of 10"x16". Over 1200 now in use throughout the world. The ideal small, accurate jig borer. Lead screws accurate to .0002" in 16".



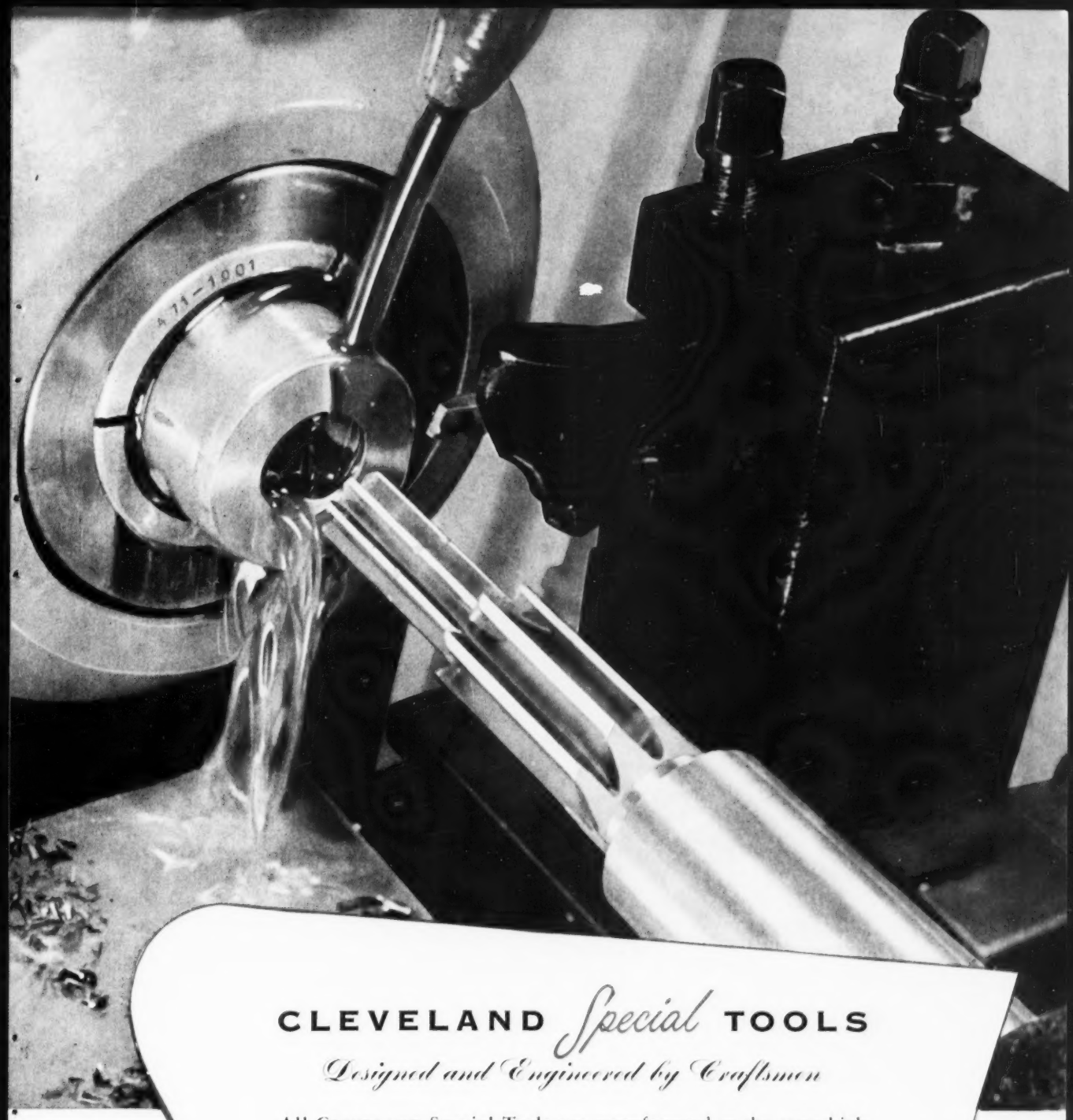
NO. 2 MOORE JIG BORER
Table working surface of 10"x19". Heavier cuts, larger holes. Features infinitely variable spindle speeds, three power feed ratios, centralized control panel.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS · JIG GRINDERS · PANTO-CRUSH WHEEL DRESSERS · DIE FLIPPERS · MOTORIZED CENTERS · HOLE LOCATION ACCESSORIES

see our catalog in MACHINE TOOL CATALOGS or write for copy

For more information on products advertised, use Inquiry Card, page 247



CLEVELAND *Special* TOOLS

Designed and Engineered by Craftsmen

All CLEVELAND Special Tools are manufactured to the same high standards of quality as regular tools bearing the famous ◇ trademark. Why not take advantage of CLEVELAND's experience, "know-how" and service in designing, producing and testing special Drills, Reamers, End Mills or other tools for your next job?

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

Before You Buy any Air-Gage

you should know these 4 facts about a T-P CompAIRator

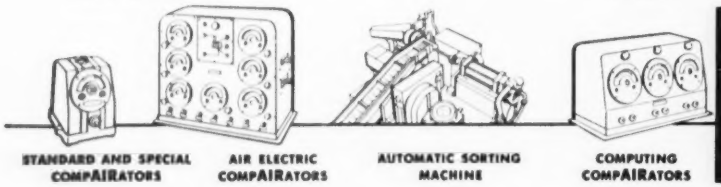
1. It's Faster! There's no flutter nor falling off of the pointer. No guesswork required. Readings are virtually instantaneous *even when long extension hoses are used.*

2. More Versatile! No other air gage matches the instant accuracy of this velocity-type circuit for such a wide variety of applications — from simple internal diameters to simultaneous checks of concentricities, squareness, center distance, etc. — bellmouth or barrel shapes.

3. It Costs Less to Operate! Vibration, hard knocks, jarring — even tilting — do not disturb the accuracy of a T-P CompAIRator. Its rugged construction eliminates expensive maintenance.

4. It Has A Wider Range! A T-P CompAIRator can be simply, quickly applied to check any dimensional relationship — even down to internal diameters as small as .055″ . . . tolerances from .0001″ to .120″. No other air gage approaches this range. It means wider application, greater usefulness, more gaging for your money.

Before you buy any air gage you'll want to talk over these advantages with a Taft-Peirce sales engineer. Discover the dollars and sense savings a T-P CompAIRator can make for you. Write today. (And ask for descriptive Handbook.)



STANDARD AND SPECIAL COMPAIRATORS | AIR ELECTRIC COMPAIRATORS | AUTOMATIC SORTING MACHINE | COMPUTING COMPAIRATORS

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

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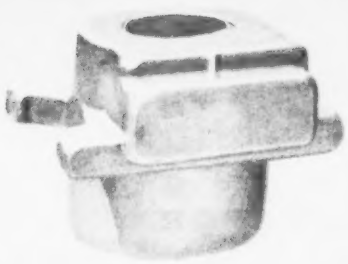


LARGE SIZES AND INTRICATE SHAPES CAN NOW BE FORGED

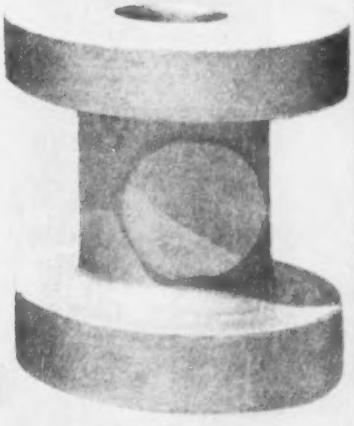
The press forgings produced by Cameron approach for the first time the broad field of intricate shapes and patterns that have been limited heretofore to steel castings. Thus, the many manufacturing advantages of steel forgings are made more widely available. These advantages include controllable grainflow characteristics and a uniformly high quality, free from internal defects such as porosity and inclusions.

The Cameron forging process opens the door to a great many design features which will aid in producing equipment of greater utility and at a lower cost in manpower and material.

FORGE AND ORDNANCE DIVISION

Cameron

IRON WORKS, INC.
HOUSTON, TEXAS



Scale — one foot

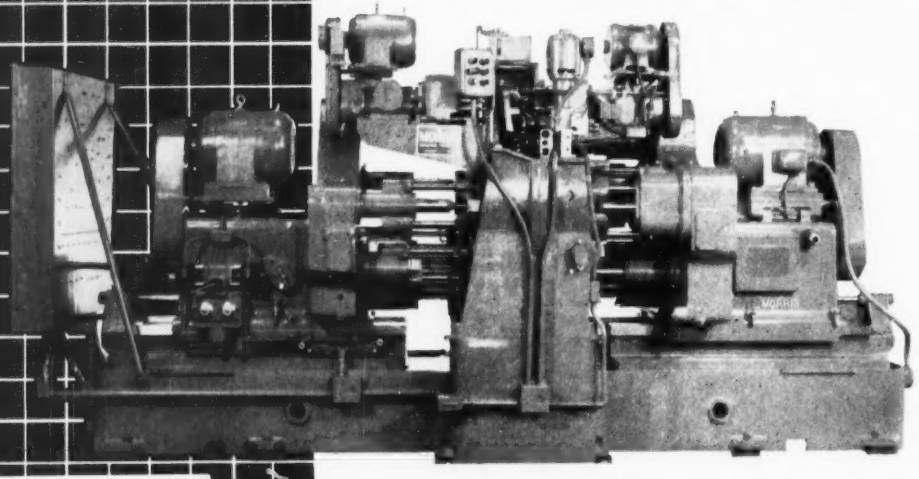
35% SAVINGS IN LABOR
REPLACES 6 OLDER MACHINES
PAYS FOR ITSELF IN 9 MONTHS

Another typical
Morris
MOR-SPEED
production machine
performance record

The two way horizontal, eight station, automatic indexing machine illustrated drills, reams, countersinks, forms radius and taps 187 refrigeration unit cylinders per hour.

This unit is equipped with nineteen drilling spindles, fourteen countersinking spindles, four counterboring spindles, one reaming spindle and eleven tapping spindles. Twenty spindles are in the left hand head and eighteen in right hand head.

If your work requires numerous operations on a mass production basis, consult us. Our engineers are eager to serve you.



OPERATIONS PERFORMED:

Drill, countersink and tap 8,—$\frac{1}{4}$"—28 tap holes

Drill, ream and chamfer both ends of $1\frac{1}{8}$" hole

Counterbore for $\frac{5}{8}$" dia. segment

Drill, countersink and tap 1—$\frac{8}{32}$ tap hole

Drill, countersink and tap 2—$\frac{3}{8}$—24 tap holes

*Refrigeration Unit Cylinder

Builders of MOR-SPEED Lines

Morris THE MORRIS MACHINE TOOL CO.
946 Harriet Street, Cincinnati 3, Ohio

"A Better Product at Less Cost with PRECISION PLUS PRODUCTION."

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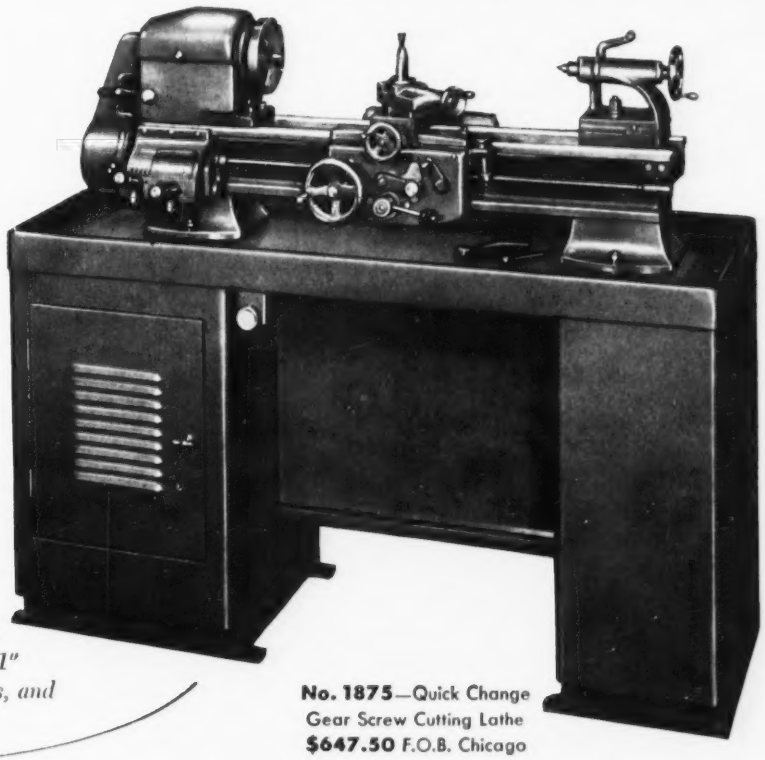
THIS Logan 10" SWING * LATHE

WILL DO THE JOB AND CUT THE COSTS... WHEREVER YOU USE IT



* *One of the many in the complete Logan line of 9", 10", 11" and 12" swing Lathes, and 8" Shapers.*

No. 1875—Quick Change Gear Screw Cutting Lathe
$647.50 F.O.B. Chicago

Brief Facts

Swing over bed, 10½"

Center Distance, 24"

Bed Width, 6 15/16"

Ball Bearing Spindle

Spindle Hole, 25/32"

16 Spindle Speeds, 38 to 1230 rpm

Double V-belt Drive for extra power to spindle is completely enclosed

Threads—46 selections, RH or LH—4 to 216 per inch

This trim, compact, 10" swing Logan Lathe is built with advanced design features and to precision standards outstanding in its field. Its spindle turns on pre-loaded *ball* bearings of extreme precision, so adaptable to all speeds they need no adjustment in the full range of 38 to 1230 rpm. The automatic apron, double-walled and friction-free, with spline driven power cross feed, has a convenient, lever-operated disc-type clutch. The two V-ways and two flat ways of the heavy-ribbed, special alloy bed are precision ground to within .0005" of perfect alignment. At vital wear points self-lubricating bronze bearings minimize friction and sustain accuracy.

Because that's the way it's built, this lathe holds exacting tolerances through extra years in production, tool room, or maintenance work. It saves space. It cuts power costs. Quick, easy set-ups minimize time loss. Apprentice operators find it easy to handle. Its price shares with you the major savings of finer tooling and efficient production in the modern Logan Plant. Ask your Logan Lathe dealer for full facts.

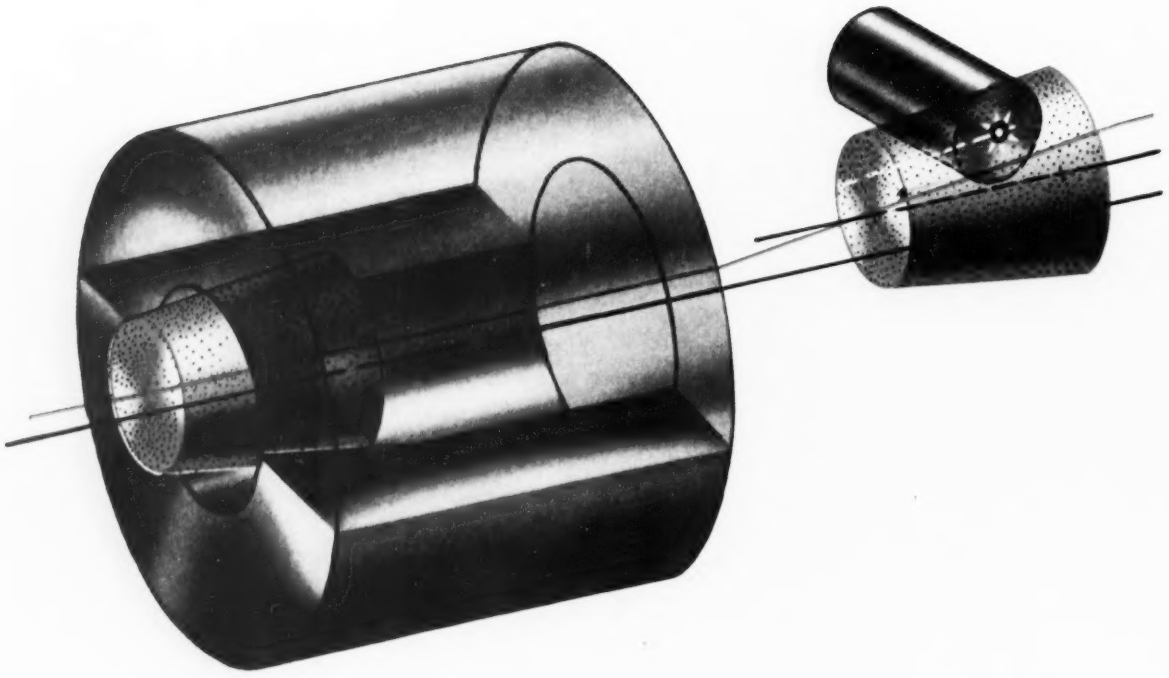
Write for the Logan Lathe Catalog

Logan ENGINEERING CO.
Lawrence and Lamon Avenues, Chicago 30, Illinois

LOOK TO Logan FOR BETTER LATHES AND SHAPERS

alignment

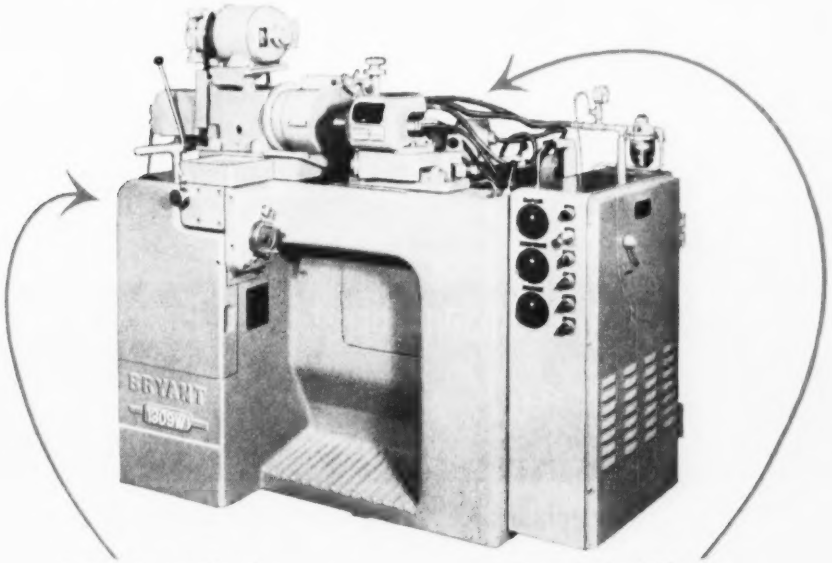
for better internal grinding



IT is common assumption in internal grinding that once the grinding wheel passes the diamond, all errors will be eliminated and the wheel will be a perfect cylinder. It is also assumed that this grinding wheel can produce a straight hole. These two assumptions are true if the wheel path is a straight line parallel with the axis of the wheel as it passes the diamond and traverses the work.

In the illustration, the wheel slides are badly worn and the wheel path is not a straight line. The distortion in the ways causes the wheel to move gradually away from the diamond and the wheel is dressed to a taper as it passes the diamond. Then, as the tapered wheel traverses the work, it will grind only on its large diameter. At the point of reversal the tapered form will be transferred to the work. If the traverse stroke is lengthened, the tapered section will be moved to the new point of reversal. In addition, wheel wear will be excessive, finish will be poor, feed lines may be visible.

Available information advises simply turning the workhead or changing the length of traverse to correct taper. In the case illustrated, neither turning the workhead nor changing the length of traverse will produce a straight hole. The only possible remedy is to straighten the wheel slide ways which will, in turn, straighten the wheel path. The wheel will then contact the work properly, producing correct geometry of the hole, longer wheel life and better finish.



Left end of workhead may be raised or lowered to bring its axis into a plane parallel with the wheel path.

Rear of wheelslide may be adjusted to insure straight line motion of the wheel.

The No. 1309-W internal grinder is for precision, production grinding of two bores and a taper at one chucking where size, concentricity and surface finish are of utmost importance. Although intended primarily for bore diameters from 1/16" to 1/2", it has a chuck swing of 9" and a maximum grinding stroke of 3 1/2". Two wheelheads are used and the work is indexed from one to the other. The wheelheads are mounted on an auxiliary angular slide for traverse grinding the taper. Preloaded ball slides on both the longitudinal and cross slides and the auxiliary angular slide assure the sensitive control necessary for grinding small bores to close tolerances. Write for folder.

Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie — free showings arranged for engineering groups.

Bryant Chucking Grinder Co.

Springfield, Vermont, U. S. A.

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

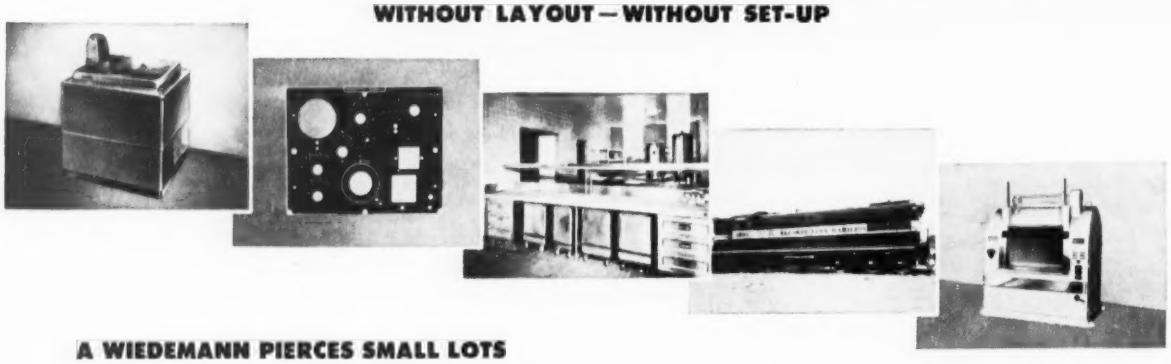
Wiedemann Turret Punch Presses

Pay Off **IN TWO YEARS OR LESS . . .**

(4000 hours of operation)

precision-pierced parts of these and similar products are produced in small lots with low tooling cost

WITHOUT LAYOUT—WITHOUT SET-UP



A WIEDEMANN PIERCES SMALL LOTS COMPLETE, IN LESS TIME THAN LAYOUT BY CONVENTIONAL METHODS

We'll gladly make a time study on your work.

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

For more information on products advertised, use Inquiry Card, page 247

Why you can *lower inspection costs*

with a Kodak Conju-Gage Gear Checker

Why the composite check

The composite check recommended in American Standard B6.11-1951 tests gears functionally by running the gear against a master of known accuracy. The resulting displacement shows at once the cumulative effect of as many as six types of error—eliminates time-consuming checks for each individual error. The check is rapid and conclusive.

Why the Kodak Conju-Gage Gear Checker

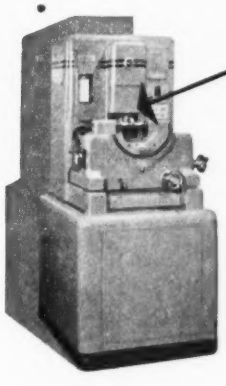
To meet today's tolerance requirements, the Kodak Conju-Gage Gear Checker uses a master made with a new order of precision. This is the Kodak Conju-Gage Worm Section, produced by thread grinding under control of a precision lead screw.

The accuracy inherent in this method means every right gear is passed by the worm section, reducing rejection losses. The transverse curvature produced by this method provides a master that can be used to check any gear of like pitch and pressure angle, regardless of helix.

Not only can a single worm section be used in place of a number of circular masters, but such a worm section can be reground to specification as often as necessary—at a fraction of replacement cost. It is easily checked for accuracy by familiar toolroom procedures.

You can find out more about the economies possible through Kodak Conju-Gage Instrumentation by sending for a copy of the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to:

Special Products Sales Division
EASTMAN KODAK COMPANY
Rochester 4, N. Y.



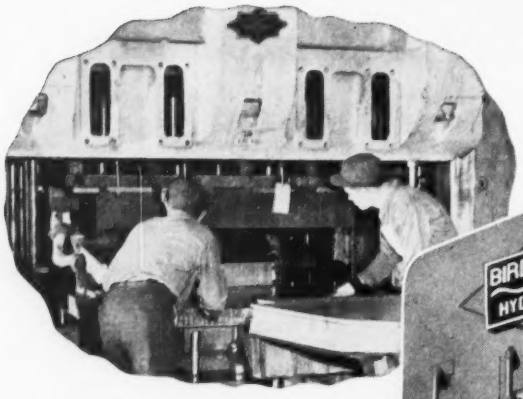
The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4⅛" pitch diameter. Larger and smaller models are also available.

CONJU-GAGE INSTRUMENTATION

... a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

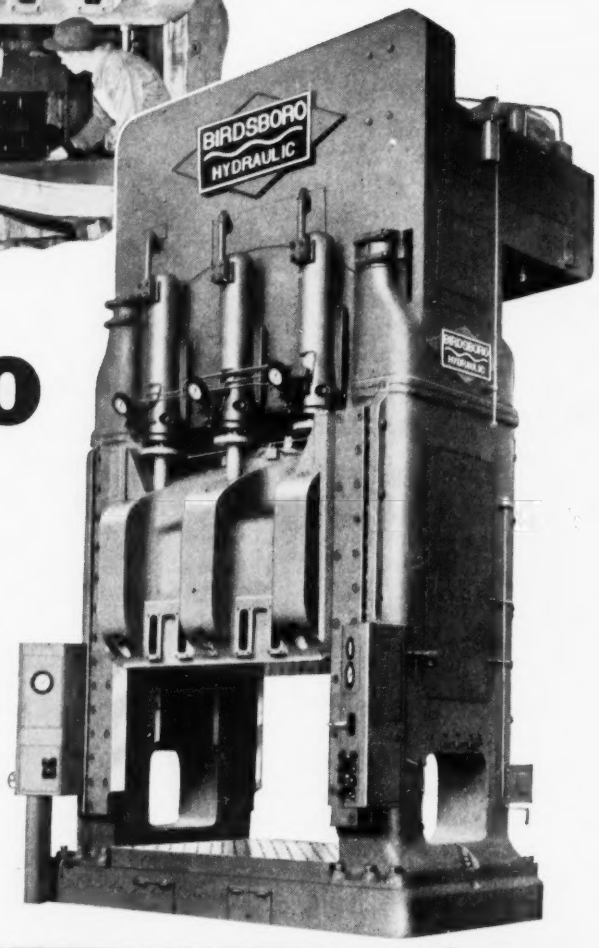
Kodak



For DEFENSE NEEDS

For CIVILIAN GOODS

You Can Count On BIRDSBORO HYDRAULIC PRESSES

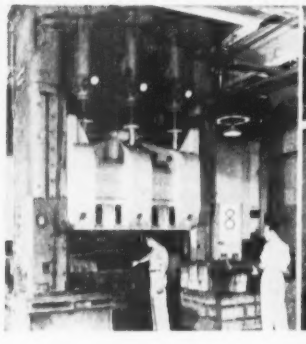


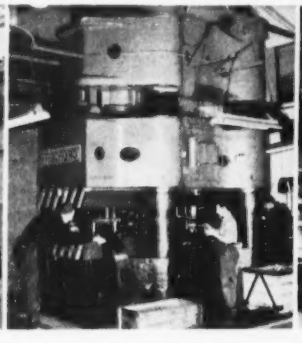
For HIGH PRODUCTION and SMOOTH OPERATION . . .

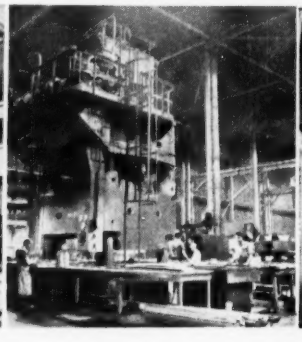
Birdsboro design-engineers are ever alert to production trends and are prepared to meet today's urgent demand for greater productive efficiency.

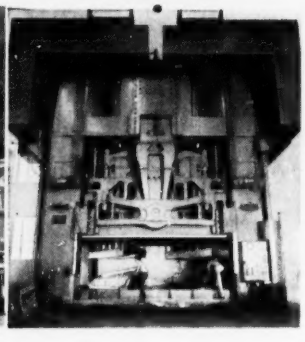
Shown here, *at work*, are a few of the many examples of Birdsboro's engineering achievements . . . hydraulic presses engaged in the important "double duty" of providing the gigantic requirements of our defense and civilian economy.

If your production problems involve hydraulic means, you can count on Birdsboro engineers to provide the proper solution.









designed & built by **BIRDSBORO**

BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA.

HYDRAULIC PRESSES

HP 11-51R

Offices in Birdsboro, Pa. and Pittsburgh, Pa.

• designers and builders of: Hydraulic Presses • Steel Mill Machinery • Crushing Machinery • Rolls • Special Machinery • Steel Castings

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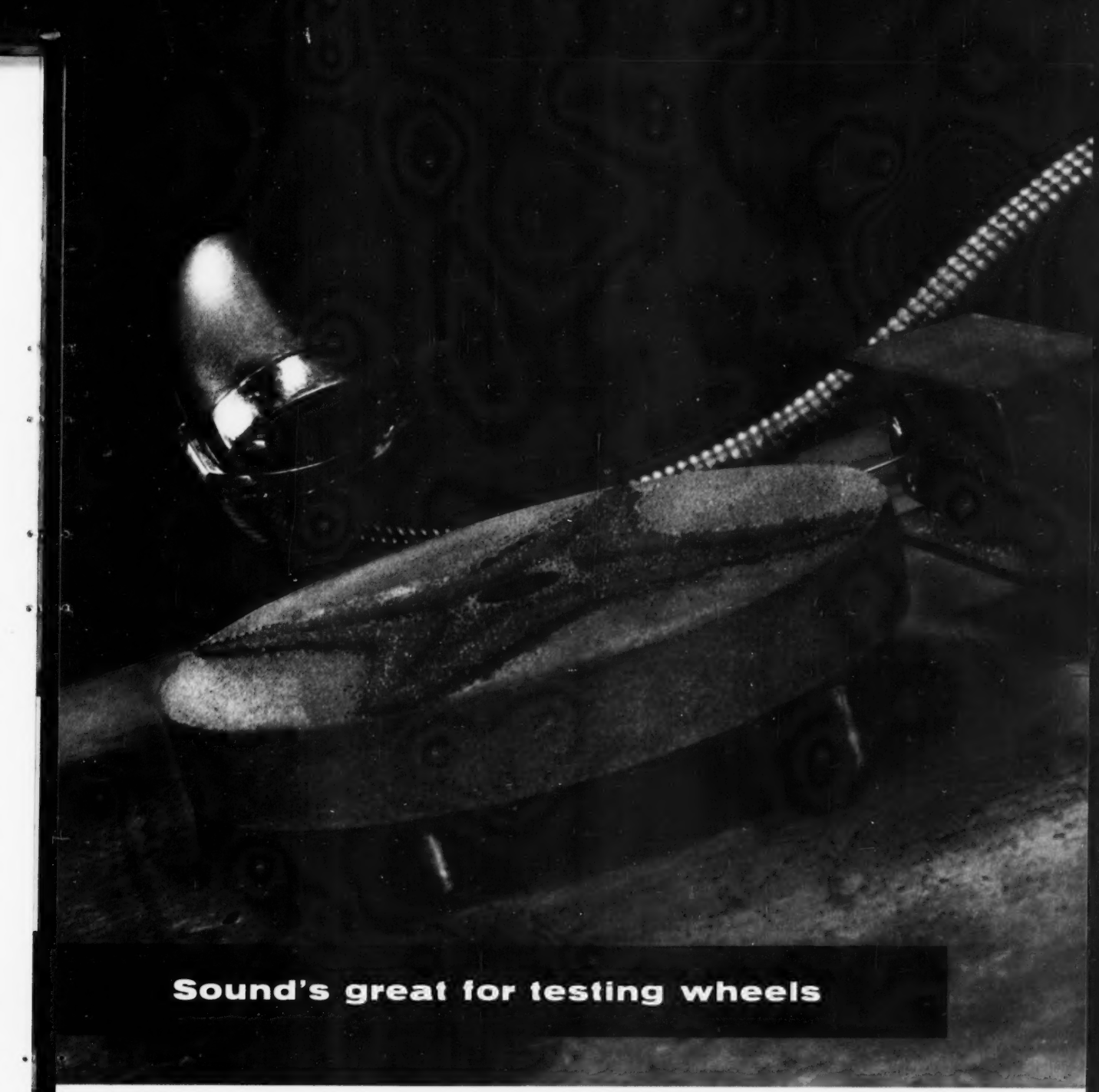


Sound's great for testing wheels

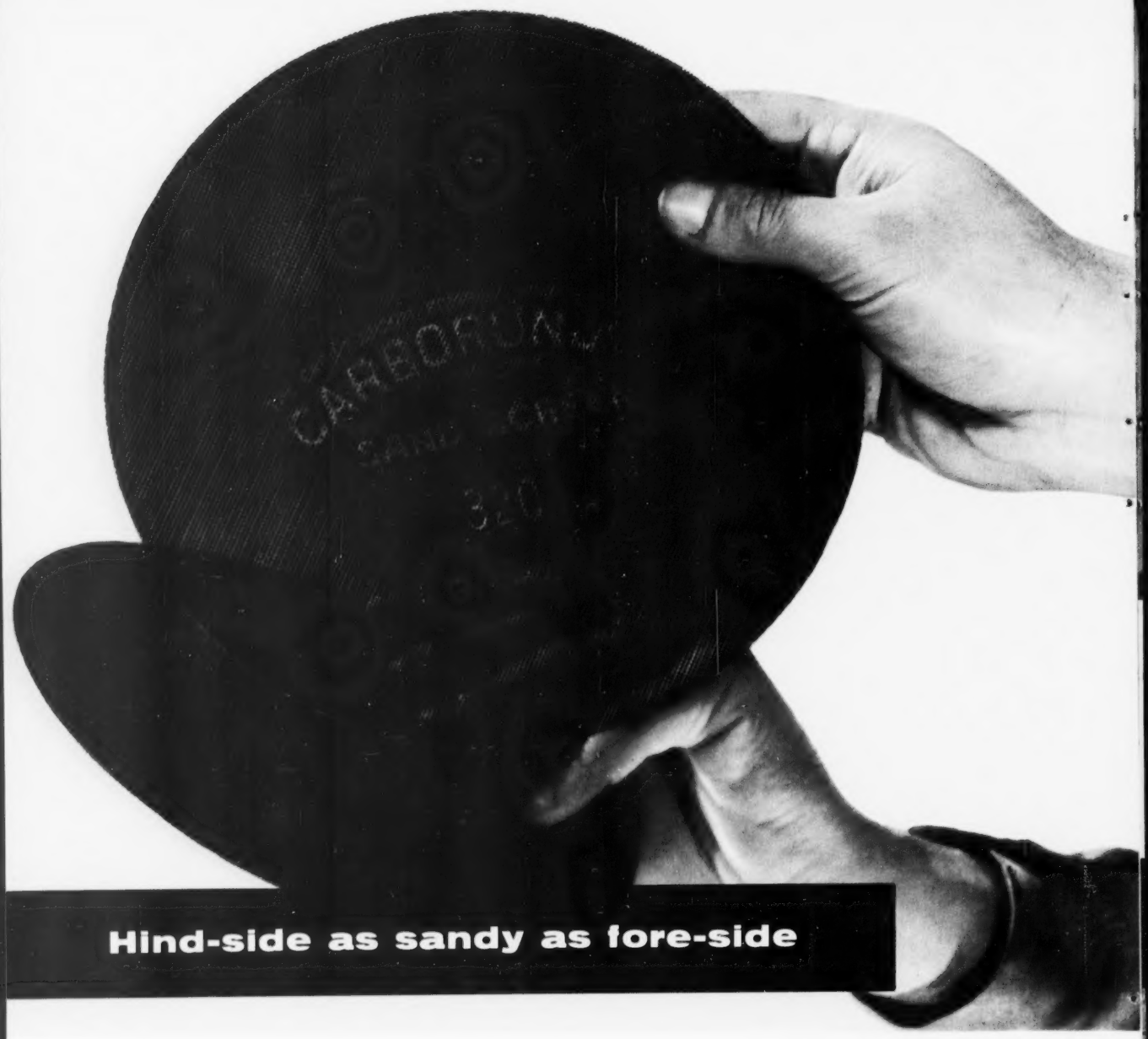
This is a "sand pattern" produced by the *sound* of a grinding wheel as it is vibrated on CARBORUNDUM's Sonic Comparator. This scientific instrument tests the hardness of wheels for precision grinding. Skilled operators hear—and see on, the oscilloscope—the sound...grade with pinpoint accuracy from 250 to 300 wheels per hour. This is just one of many scientific tests applied to grinding wheels by CARBORUNDUM—to make sure you get absolutely uniform production from wheel to wheel. For precision grinding wheels that match the performance of modern grinding machines, it pays to rely on your CARBORUNDUM Distributor or Salesman. He offers expert counsel, complete stocks, prompt service. Call him today.

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar



Hind-side as sandy as fore-side

Use *both* sides of SAND SCREEN for sanding and finishing...do from 7 to 15 times more work with one sheet or disc than you can with conventional coated abrasives. Removed material flows through the open mesh—you sand faster, longer, with much less loading. Use SAND SCREEN wet or dry...for hand or machine finishing. Fold it—tear it to any convenient size. CARBORUNDUM'S SAND SCREEN Discs and FASTCUT Pad 85 Assembly slash time and costs on wet sanding of prime coats. On many operations of sanding flats and slight contours, no adhesives are necessary. Cut sheets fit oscillating or vibrating sanders... do a terrific job wherever loading and glazing is a problem. Get samples today from your CARBORUNDUM Distributor or Salesman.

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

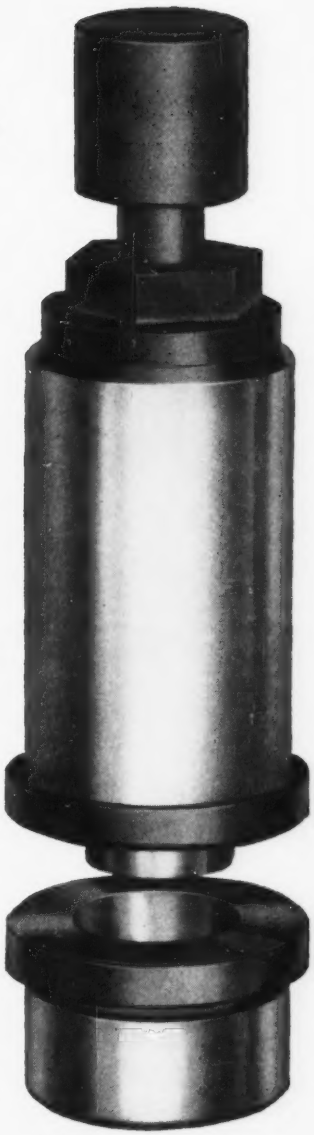
continually puts more sense in your abrasive dollar

STANDARDIZED

UNIVERSAL INDEX PLUNGERS

SAVE TIME
SAVE MONEY

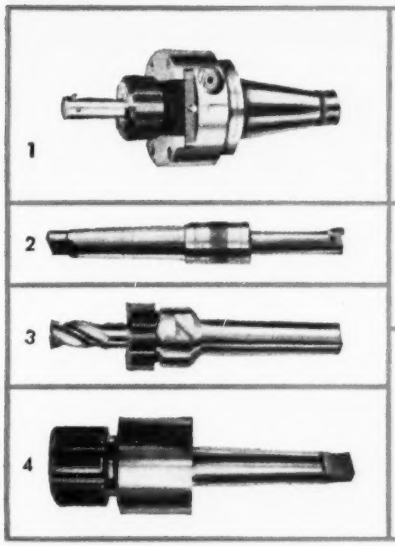
Universal's Straight and Taper Plungers made in standard sizes save the time and expense of designing and machining special index plungers for multi-station tools. They come to you complete, ready for installation at approximately ¼ the cost of specially made plungers.

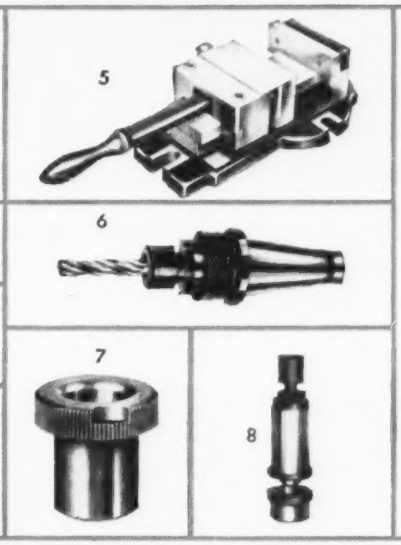


Soft pin knob permits connection to actuating lever or air cylinders by several different methods. Locating bushing, plunger and plunger bushing are hardened and ground.

Plunger is easily assembled from either top or bottom. And it can be removed in either direction by removal of hex nut.

Universal Plungers greatly simplify jig or fixture manufacture because plunger body and bushing have same diameter so that all holes can be bored with same tool, often in same setting.





UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2
MICHIGAN

(1) BORING CHUCK
(2) MIKRO-LOK BORING BAR
(3) STANDARD COLLET CHUCK
(4) FLOATING COLLET CHUCK
(5) WEDGE-LOCK PRODUCTION VISE
(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER

168

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New BAKER Automatic MACHINES 15,000 lb. TANK HULL as it passes along 100 FOOT RAILS!

OPERATIONS: DRILLING . . . TAPPING . . . BORING . . . FACING on 102 holes . . . plus 10 main bores. Mounted on a specially-built floating concrete slab, this huge new Automatic Baker Transfer Machine accurately performs multiple drilling, tapping, boring and facing operations on 15,000 pound rough weldments 9 feet wide and 16 feet long. Savings achieved in production costs with a machine of this type are tremendous. Baker engineering know-how stands ready to solve your production problems . . . with cost cutting standard or special, single or multi-operation machines.

Write regarding your specific job problems . . .

BAKER BROTHERS, INC. Toledo, Ohio
DRILLING . . . TAPPING . . . KEYSEATING and CONTOUR GRINDING MACHINES

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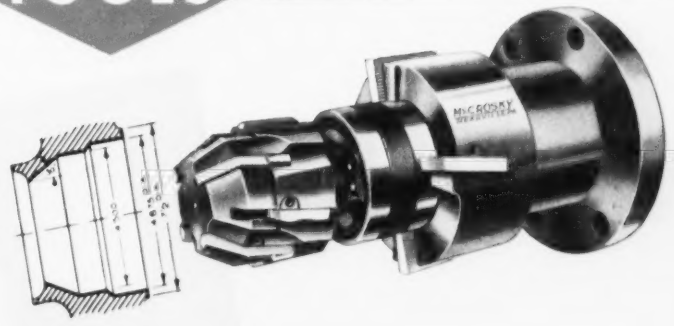
McCROSKY

1904-1954 COST CUTTING TOOLS 50TH ANNIVERSARY

Specially Engineered

Multiple Operation

TOOLS



cut machining and set-up time, assuring close alignment of all surfaces, and unsurpassed uniformity and concentricity of finished pieces . . .

Individually engineered to the requirements of each particular job, McCrosky "Specials" combine related boring, facing, chamfering and reaming operations:—do them all at the same time with just one tool and one set-up. McCrosky "Specials" cut costs and practically eliminate spoilage and rejects. They pay their way on short or long production runs.

Use of McCrosky's Jack-Lock and Super-Jack Wedges and other shop-tested features give McCrosky "Specials" the strength and rigidity of solid tools yet permits the blades to be released and adjusted for regrinding easily and quickly,—saving time, minimizing the amount of blade stock ground away, and requiring fewer tools to keep a job running continuously.

Send for Bulletin No. 17-S. It illustrates more than 40 applications of McCrosky "Specials" and will suggest places where you too can use them to turn out better products, quicker and cheaper!

McCROSKY *Universal* MILLING CUTTERS

Body can be bladed to rotate either right or left hand. Consequently, selecting blades with tips of proper material mounted at proper angles produces a cutter that meets any metal or machine condition. Write for Bulletin No. 531 today.

McCROSKY *Super Adjustable* REAMERS

Complete line includes chucking reamers with straight or tapered shanks, shell reamers with tapered holes for standard arbors or large straight holes for line bar reaming. Stock sizes from 15/16" to 6" diameter. High speed, cast alloy or carbide tipped blades. Write for Bulletin 18-R.

McCROSKY *Jack-Lock* MILLING CUTTERS

Face Mills, Shank and Shell End Mills, Half Side and Staggered Tooth Milling Cutters fitted with high speed steel, cast alloy or carbide tipped blades. Sizes from 3" to 24" in diameter to meet any requirement. Write for Bulletin No. 17-M.

McCROSKY *Block Type* BORING BARS

Individually ground and hardened tapered V-key center the block and cutting blades accurately and rigidly yet permits easy release for regrinding and "floating" with extreme accuracy when making finishing cuts. Wide range of stock sizes. Write for Bul. 17-B.

McCROSKY *Wizard* QUICK-CHANGE CHUCKS

McCrosky's Wizard Quick-Change Chuck and Collet outfits hold tools centered and rigid. They enable the operator to change tools easily and quickly, without stopping or slowing down the spindle. Successive operation jobs become continuous. Write for Bulletin 18-C.

McCROSKY *Turret* TOOL POSTS

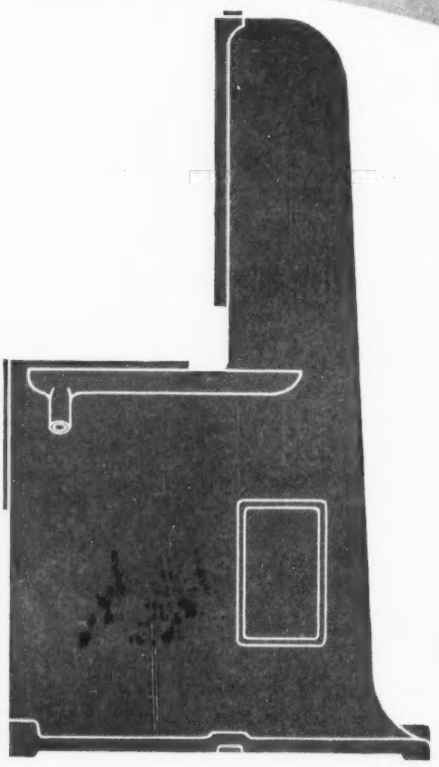
These tool posts permit successive tools to be swung into cutting position quickly, indexed accurately, and locked rigidly, giving engine lathes many of the advantages of turret lathes. Four styles—11 sizes. Write for Bulletin 17-T.

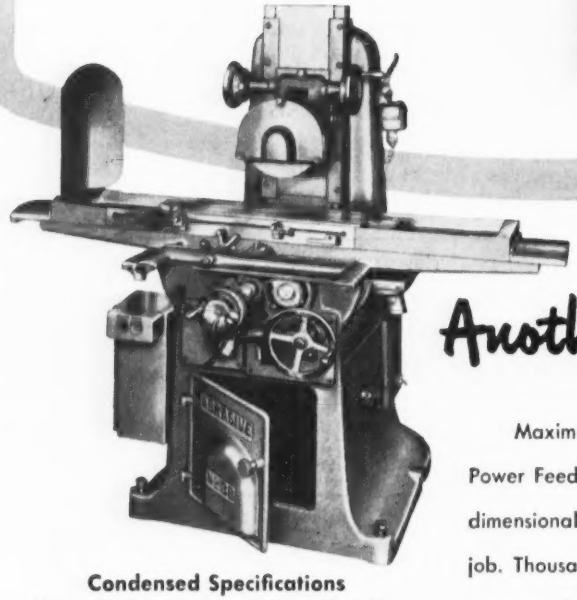
COST CUTTING TOOLS **McCROSKY TOOL CORPORATION**

MEADVILLE, PA.

Engineering and Sales Representatives in the Principal Cities

ONE PIECE BED...





Another big plus for the 3-B

Maximum stability — a designed-in feature of Abrasive 3-B Power Feed Surface Grinder — insures perfect alignment, accurate dimensional control, and smooth surface finish on every grinding job. Thousands of these dependable grinders are serving in toolrooms and on production lines . . . producing precision work fast and efficiently. Find out how the Abrasive 3-B can help in your plant . . . write for descriptive catalog. Abrasive Machine Tool Company, 12 Dunellen Road, East Providence 14, Rhode Island.

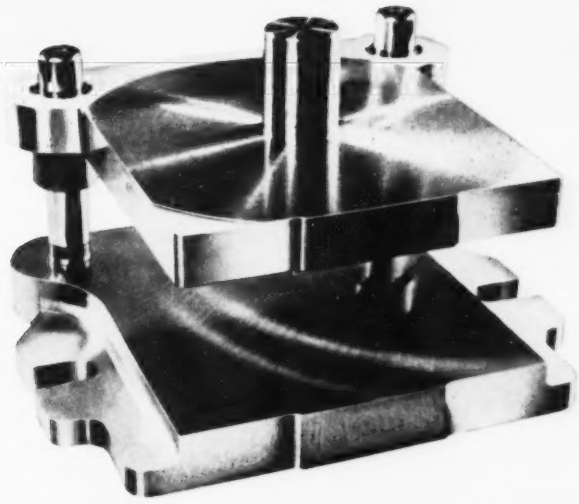
Condensed Specifications

Type: Horizontal spindle, reciprocating table.
Capacity: 24" long x 8" wide x 12" high.
Feeds: Automatic in longitudinal and transverse directions.
Automatic cross feed (0 to .070" at either or both ends of table travel).
Wheel: Standard Type 1 — 10" diam. driven by 3 HP, 1750 RPM motor.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality Is Reflected in the Finish of Your Product

For more information on products advertised, use Inquiry Card, page 247



DANLY'S IN THE PICTURE

at Eastman Kodak Company

Danly Die Sets play an important role in the manufacture of Eastman's popular new Brownie movie camera and Brownie movie projectors . . . latest in the Eastman line that Danly Die Sets have helped build all through the years. Used to mount high precision dies, Danly Die Sets help bring "master die" accuracy to every finished part. But Danly Die Sets do more . . . even before a press run ever starts. They make tooling-up easier, faster—save you many, many hours in the die shop. And once in production, these same Danly Die Sets do their share to maintain non-stop production . . . save down-time . . . increase die life. And remember, Danly Die Set service is as quick and convenient as a phone call.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

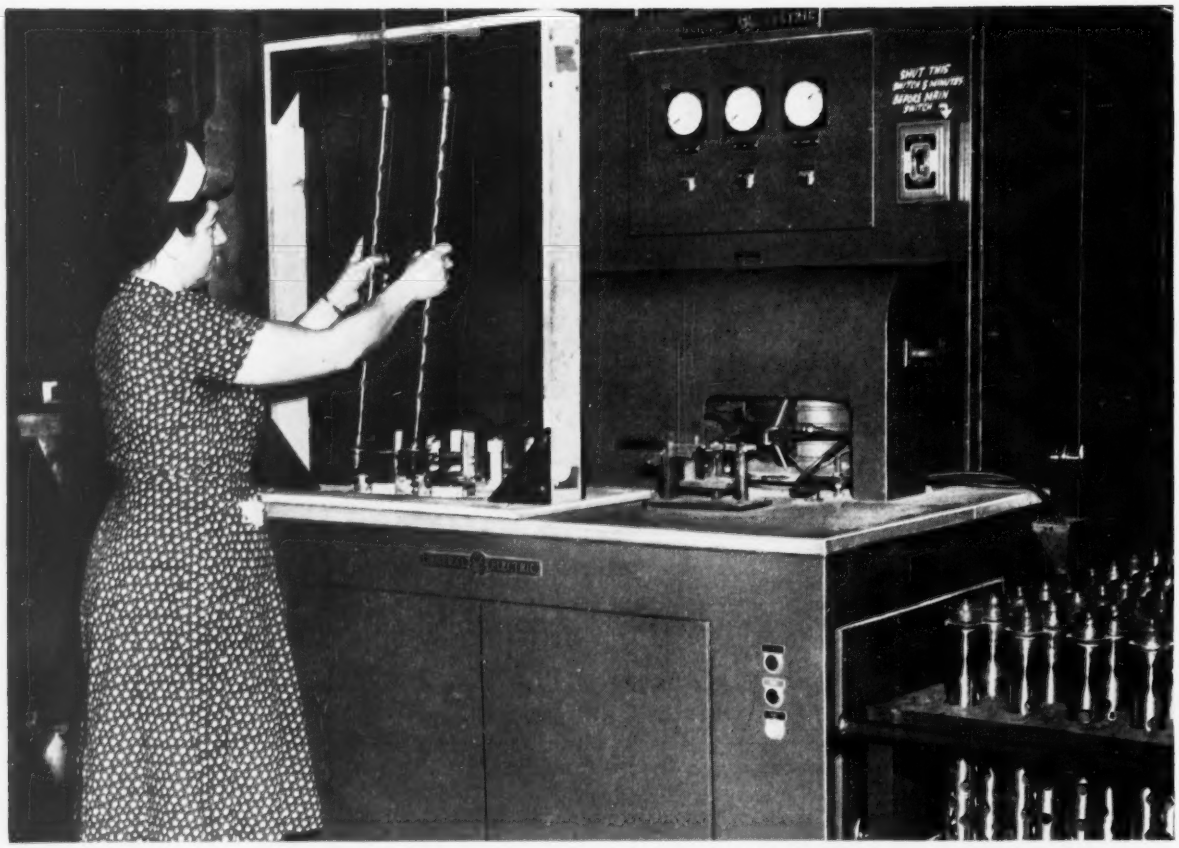
DANLY

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

PICK THE DANLY BRANCH NEAREST YOU!

***CHICAGO** 50	2100 S. Laramie Avenue
***CLEVELAND** 14	1550 East 33rd Street
***DAYTON** 7	3196 Delphos Avenue
***DETROIT** 16	1549 Temple Avenue
***GRAND RAPIDS**	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
***LONG ISLAND CITY**	47-28 37th Street
***LOS ANGELES** 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
***PHILADELPHIA** 40	511 W. Courtland Street
***ROCHESTER** 6	33 Rutter Street

**Indicates complete stock.*



COMPACT G-E HEATERS FOR BRAZING FIT PERFECTLY INTO NEW STRAIGHT-LINE PRODUCTION SETUP AT THE SACO-LOWELL CO.

Rejects Eliminated in Gun-jacket Assembly

Saco-Lowell Company speeds production, cuts costs with G-E Induction Heaters

"In planning our machine-gun production program, we find G-E induction heaters assure us the high-quality brazing necessary to meet strict Ordnance Department requirements," says F. A. Skinner, Chief Engineer, Edwards Plant, Saco-Lowell Shops, Biddeford, Maine.

At Saco-Lowell, brazing rejects are a thing of the past. Only spot checks are necessary for product inspection, because G-E heaters provide a strong, uniform braze time after time. Saco-Lowell saves on operator training too, because use of these semi-automatic G-E heaters is mastered easily in a few hours.

To learn how you can profitably apply induction heat to your metal processing—in brazing, forging, hardening, or annealing—contact your nearest G-E Apparatus Sales representative today. And write now for new, modern-metal-processing bulletin GEA-5889 on furnace and induction brazing to General Electric Company, Section 720-122, Schenectady 5, N. Y.

GENERAL ELECTRIC

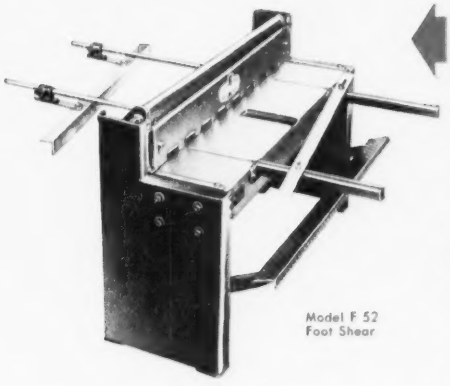
SELECTIVE HEAT produces this clean, strong bond of bearing breach to barrel jacket. Sixty such joints are brazed per hour.

For more information on products advertised, use Inquiry Card, page 247

Announcing a *NEW* SHEAR LINE by...

famco

● 18 FOOT, AIR AND POWER-DRIVEN MODELS CUT 14-20 GAUGE



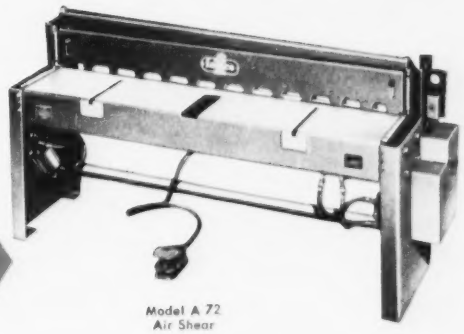
Model F 52
Foot Shear

Foot Shears in 6 models

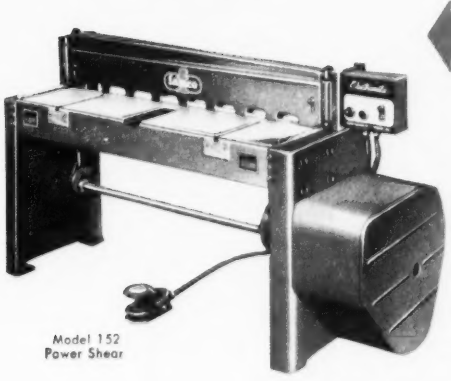
Capacity: 16 gauge mild steel in 36", 42" and 52" widths, and 18 gauge in 22", 30" and 72" widths. All-steel box-type construction.

Air Shears in 4 models

Capacity: 16 gauge mild steel in 36", 42", 52" and 72" widths. Feature low initial cost, ease of operation.



Model A 72
Air Shear

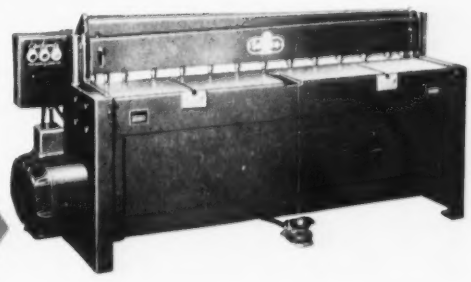


Model 152
Power Shear

Power Shears in 8 models

Capacity: 18 and 20 gauge mild steel in 36", 42", 52" and 72" widths. Feature "Electromatic Clutch" with faster operating speeds.

Capacity: 14 and 16 gauge mild steel in 36", 42", 52" and 72" widths. Feature "Electromatic Clutch" and rugged gear transmission, roller bearing equipped.



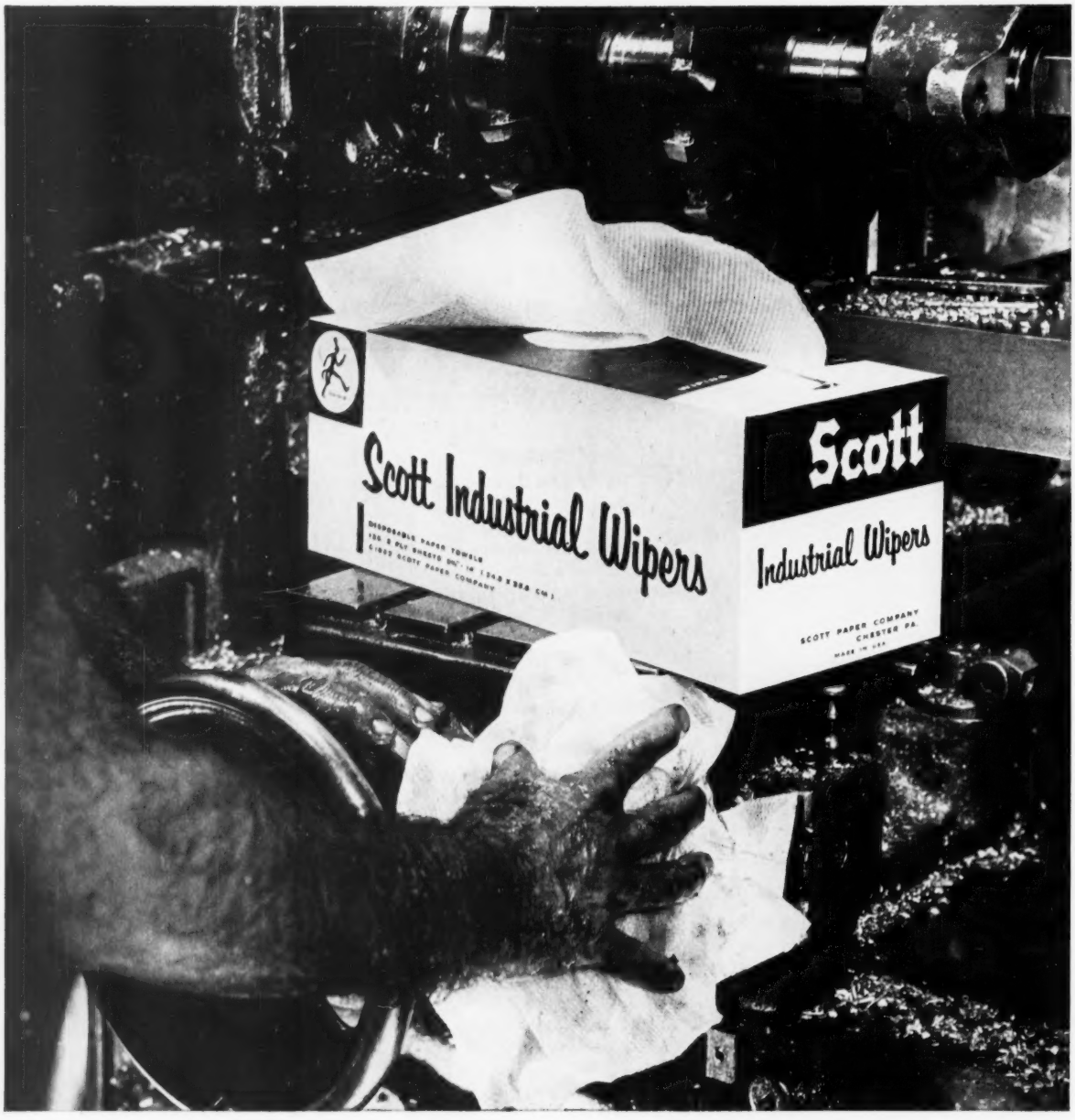
Model 1672
Power Shear

The new Famco complete Shear Line brings to American Industry new, modern concepts in Foot, Air and Power Shear features, efficiency and design at new savings in time and money. Famco has anticipated future shear developments such as all-steel construction possessing new rigidity and inert structural strength; four-edged alloy blades; and exclusive Famco "Electromatic" clutch . . . the electrically operated 9-point jaw clutch. In addition, Famco controls produce a new high in safety factor levels, never before possible with this type of equipment. For further details, see your dealer or write for free catalog.

famco machine company

3134 SHERIDAN ROAD • KENOSHA, WISCONSIN

AIR PRESSES • ARBOR PRESSES • BAND SAWS • DRILL PRESSES • FOOT PRESSES • POWER PRESSES • SQUARING SHEARS



To meet a human need . . .

We believe that the hands of America's workers are industry's most important tools. For this reason we are proud to introduce the **Scott Industrial Wiper,*** which is successfully meeting the wide range of wiping needs in industry. It is a general-purpose, disposable wiper designed to handle your jobs safely, efficiently and economically. A Scott man stands ready to demonstrate this product in your plant.

*PAT. PEND

SCOTT PAPER COMPANY, CHESTER, PENNSYLVANIA

For more information on products advertised, use Inquiry Card, page 247

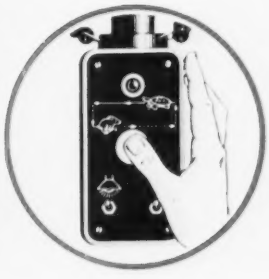
Introducing the new American built...

PILOT

COMPLETELY AUTOMATIC

high speed **HYDRAULIC COPYING LATHE**

See its amazing speed at the **A.S.T.E. EXPOSITION** *in* **PHILADELPHIA,** *April 26-30, Booth 509*



Now completely built in the United States to JIC standards by Industrial Metal Products Corporation, Lansing, Michigan.

Turn the page to see the Pilot's outstanding features

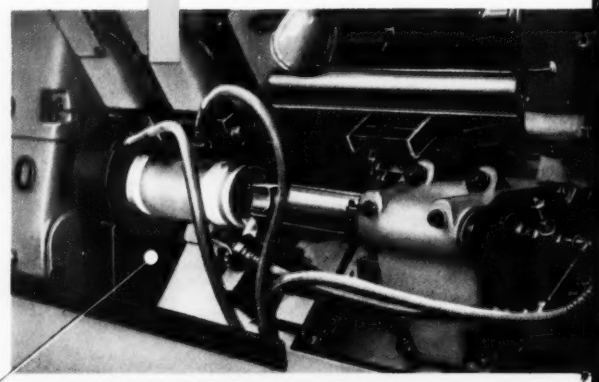
Throughout the world...

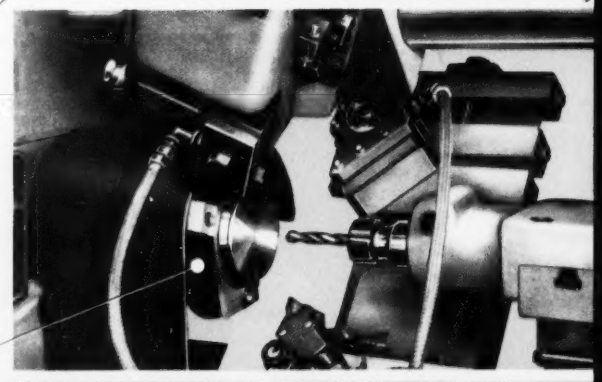
Progressive plants that demand the best say H.E.B. is "the way to turn"

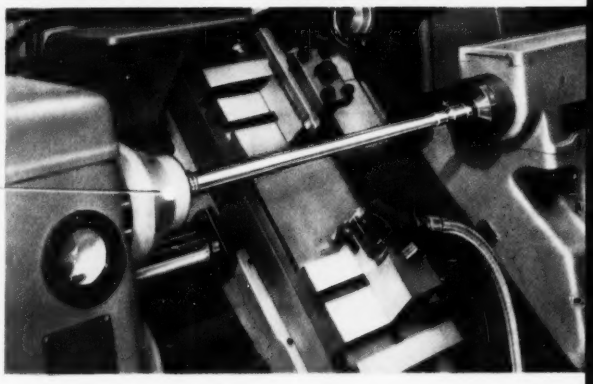
See the H.E.B. Pilot in action at the A.S.T.E. Exposition in Philadelphia, April 26-30, Booth 509

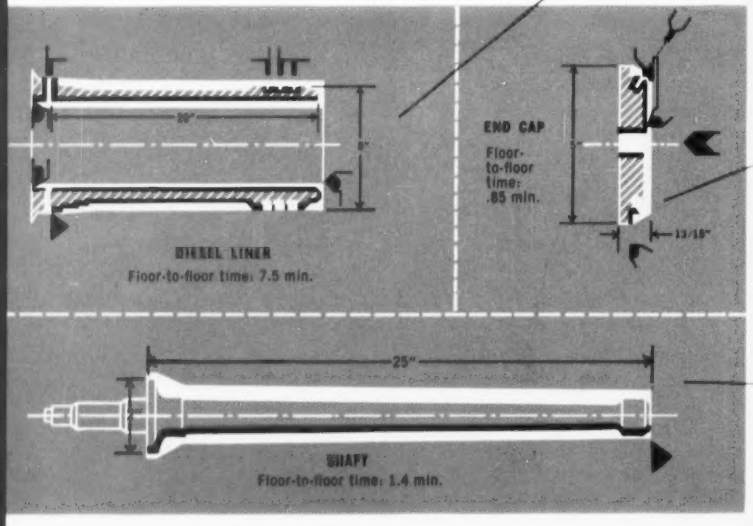
CHECK THESE REASONS WHY:

- Completely automatic; operator only loads.
- Motors up to 60 HP; spindle speeds 380 to 3000 RPM.
- Standard power operated back tools can be used for copy turning, finishing or undercuts.
- Takes as many as eight different cuts in one cycle if necessary.
- Patented hydraulic carriage feed easily adjusted and vibration-free. Once set, remains absolutely constant.
- Accuracy of .0005" and 32 micro-inch finish obtainable.
- Hydraulically powered infeed slides available.
- Adequate coolant supply built into toolblock.
- Splash guard mounted on rollers.
- Fewer tools necessary, resulting in less down-time.
- Twin cross slides, infinitely variable spindle speeds for constant cutting speed available.









H.E.B. Hydraulic Copying Lathes are also manufactured in OP Models with 20 HP motor; take heavy cuts with carbide tools at spindle speeds 50 to 3600 RPM, economical for short runs . . . And in GT Models with rotating pattern designed to copy an infinite variety of non-circular work.

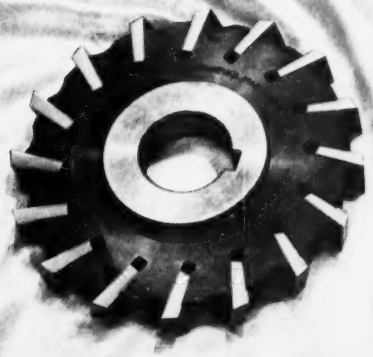
The new, fully automatic H.E.B. Pilot is a triumph of production engineering—culmination of years of brilliant research by H.E.B., specialists in lathe manufacture and pioneers in the field of copy turning.

H·E·B
"THE WAY TO TURN"

H.E.B. MACHINE TOOLS, INC.
475 Fifth Avenue, New York 17, N. Y. • LExington 2-0266

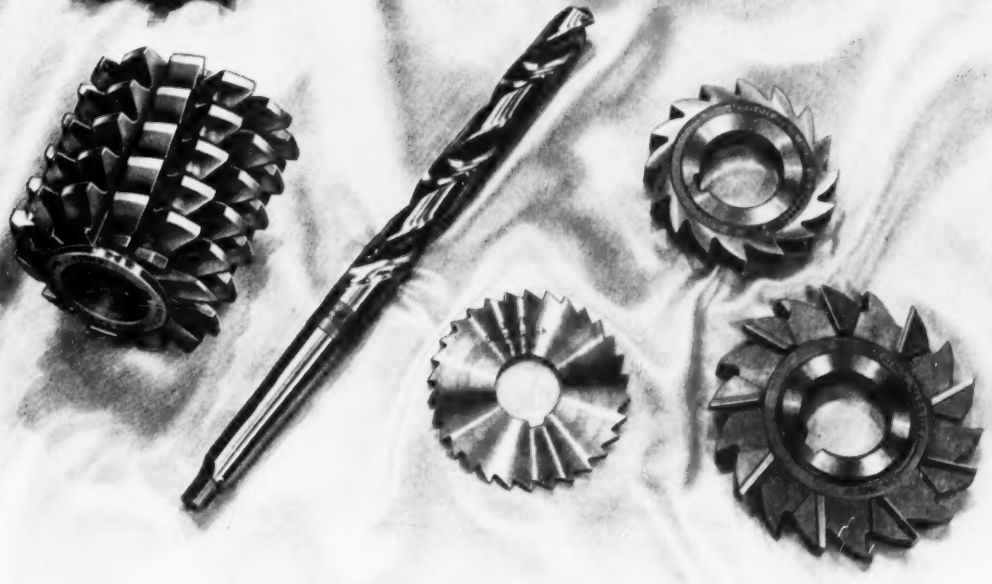
COPYING LATHES • ENGINE LATHES WITH COPYING ATTACHMENTS • CARBIDE TOOL GRINDERS • RADIAL DRILLS

UNION



Ever since the 17th century, for beauty of tone, form and craftsmanship, the violins of Antonio Stradivari have stood out as masterpieces.

Among all modern cutting tools, those produced by Union are outstanding in their uniform quality, precision and long life.



The "HALIR" violin from the collection of Frederick S. Haenel, Gaylordsville, Conn.

TWIST DRILLS
Straight Shank
Screw Machine
Taper Shank
Three & Four Groove
Heavy Duty
Extra Length
Aircraft
Automotive
Carbide

CUTTERS
Milling
Staggered Tooth
Gear
Screw Slotting
Woodruff
Corner Rounding
Angle

HOBS
Spur Gear
Stub Tooth
Involute Spline
Sprocket

METAL SLITTING SAWS
Concave Sides
Formed Teeth
Side Chip Clearance

INSERTED BLADE CUTTERS
Side Mills
End Mills
Reamers
Slotting Cutters

REAMERS
END MILLS
COUNTERSINKS
COUNTERBORES
CARBIDE TOOLS

UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

End Mills Milling Cutters Gear Cutters Twist Drills Hobs Reamers Carbide Tools

OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

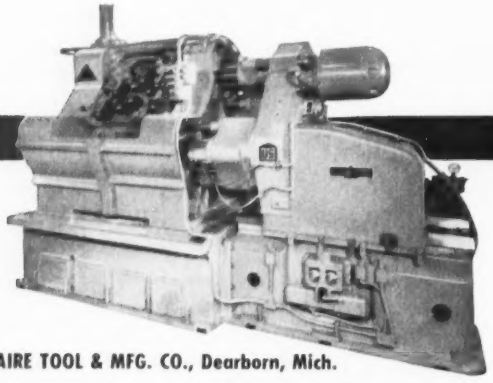
CUT INVENTORY COSTS, ORDER FROM YOUR LOCAL DISTRIBUTOR

THESE MACHINE TOOL BUILDERS RELY EXCLUSIVELY ON US INDIVIDUAL LEAD SCREW TAPPERS WITH SHAVED GEARS AND THE PATENTED *SAFETY TAP HOLDER*

The U. S. ***Safety Tap Holder*** is the only Tap Holder which automatically resets the spindles for continuous machine cycling while preventing tap breakage due to bottom tapping, dull taps or holes not drilled.

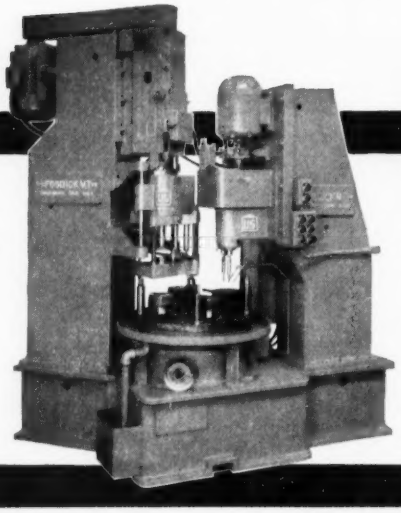
AVEY DRILLING MACHINE CO., Covington, Ky.

This complete tapping machine has provisions for a fifth U. S. Head to be added at a later date. All lead screw tappers are equipped with shaved gears and the U. S. patented ***Safety Tap Holders.***



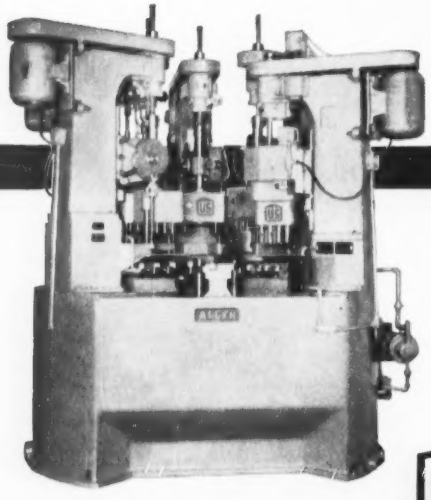
LEMAIRE TOOL & MFG. CO., Dearborn, Mich.

This machine drills, reams, chamfers and taps holes in a crank shaft for a farm tractor engine using a U. S. combination head, having individual lead screws with the U. S. ***Safety Tap Holder*** at the tapping station.



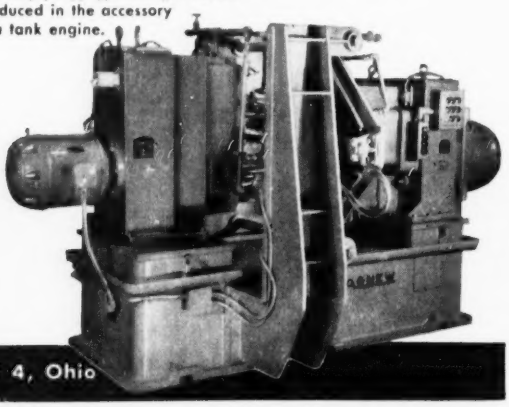
FOSDICK MACHINE TOOL CO., Cincinnati, Ohio

Combination drill and tapping machine still in use after many years, at an automotive accessory plant. Operation performed on a motor sheave.



AGNEW ELECTRIC CO., Milford, Mich.

A complete tapping machine having a total of 76 spindles. One 38 spindle, one 20 spindle and one 18 spindle U. S. individual lead screw tapper. Straight threads ¼-20 to ½-13 and tapered pipe ⅛-¾ class #3 thread were produced in the accessory case of a tank engine.



CHARLES G. ALLEN CO., Barre, Mass.

This machine has operated 16 hours per day since 1950, performing a bottom tapping operation in every cycle without a replacement part required on any portion of the lead screw spindle.

US HEADS

U. S. DRILL HEAD CO., 616-618 Burns St., Cincinnati 4, Ohio

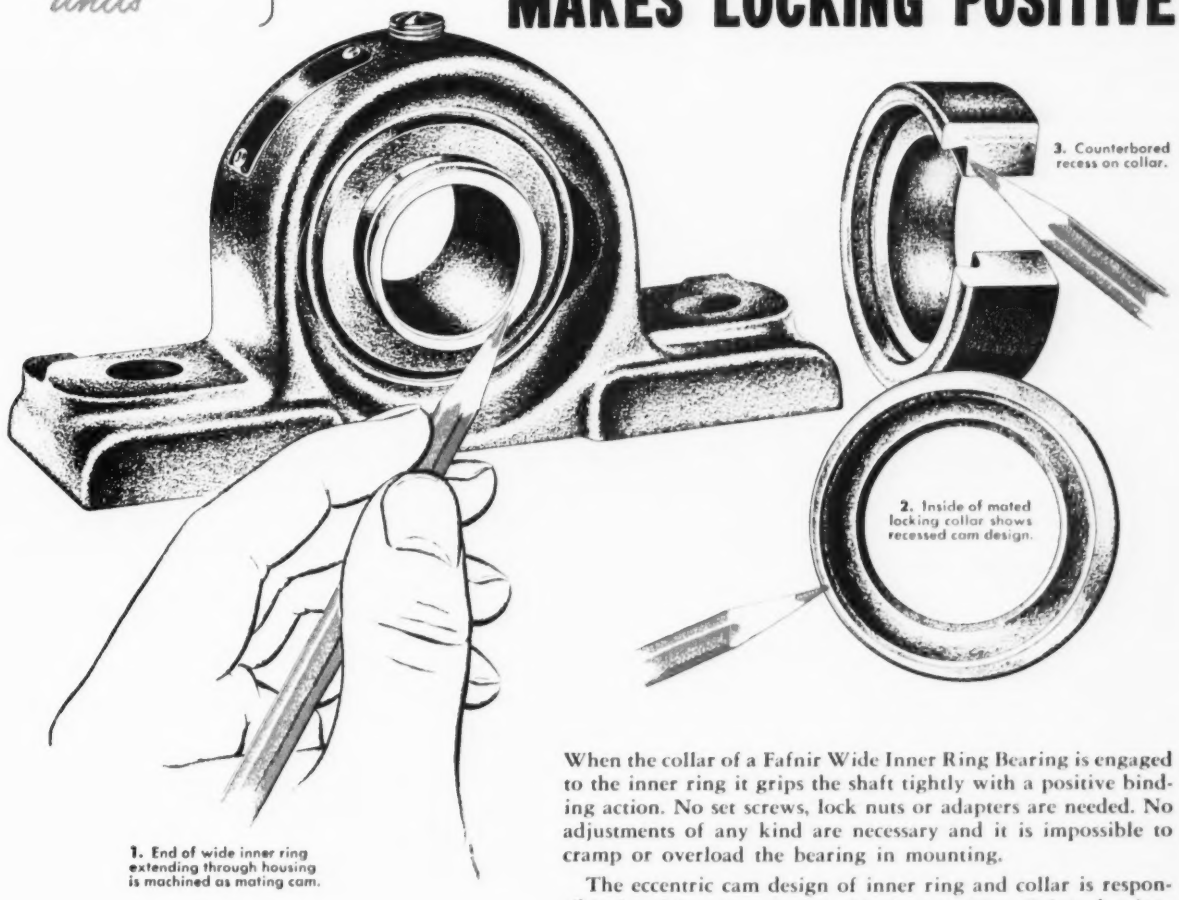
For more information on products advertised, use Inquiry Card, page 247

preference points on power transmission units

ECCENTRIC CAM DESIGN

of Inner ring and collar

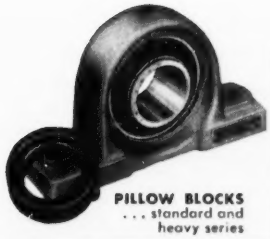
MAKES LOCKING POSITIVE


3. Counterbored recess on collar.
2. Inside of mated locking collar shows recessed cam design.
1. End of wide inner ring extending through housing is machined as mating cam.

When the collar of a Fafnir Wide Inner Ring Bearing is engaged to the inner ring it grips the shaft tightly with a positive binding action. No set screws, lock nuts or adapters are needed. No adjustments of any kind are necessary and it is impossible to cramp or overload the bearing in mounting.

The eccentric cam design of inner ring and collar is responsible for this extremely valuable feature. It's a Fafnir development . . . tried and proven over the years. Shaft scoring is no longer a problem . . . and shaft slippage is out. The Self-Locking Collar transmits all thrust loads to the bearing.

For straight shaft mounting, the Fafnir Wide Inner Ring Bearing with Self-Locking Collar continues to rate "tops" as a feature of power transmission units. Every day it makes possible greater simplicity of mounting, economy of design, assembly and maintenance costs. For complete information call your Fafnir Representative. The Fafnir Bearing Company, New Britain, Conn.



PILLOW BLOCKS
. . . standard and heavy series

FLANGE CARTRIDGES
. . . standard and heavy series

CYLINDRICAL CARTRIDGES
. . . . standard and heavy series

WIDE INNER RING BALL BEARINGS
. . . with Mechani-Seals

FAFNIR

BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

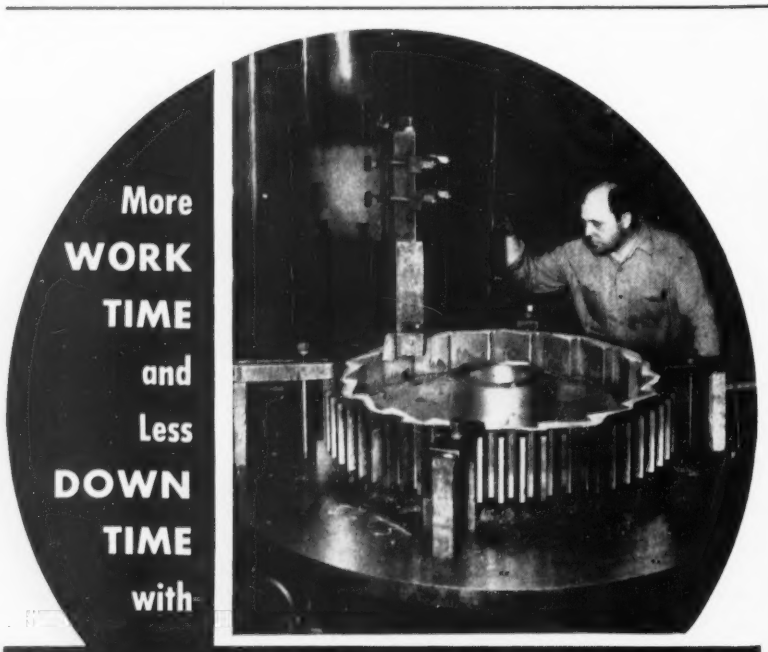
ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.



ROCKFORD CLUTCHES

ROCKFORD CLUTCHES are factory, field and road tested to make sure they will stand up under the torque, shock load, engagement frequency and duration, slippage, reversal, etc., required by the machines in which they are to operate. Because of this exacting on-the-job application, down-time for clutch adjustments or repairs has been reduced to a minimum. Let ROCKFORD engineers help you get more work time from your machines.

BW ENGINEERING MAKES IT WORK... PRODUCTION MAKES IT AVAILABLE

Send for This Handy Bulletin

ROCKFORD CLUTCH DIVISION BORG-WARNER
410 Catherine Street, Rockford, Illinois, U.S.A.

Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Aluminum
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

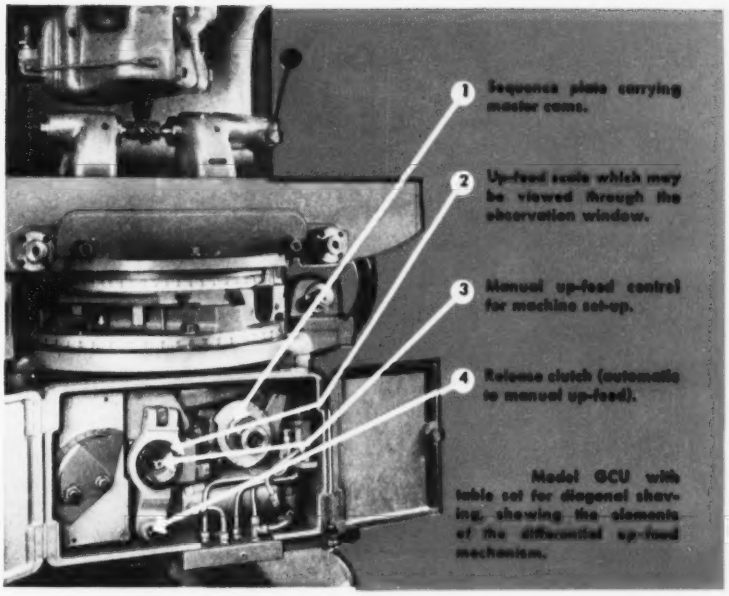
ARBORS AND MANDRELS
Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page 312*)

For more information on products advertised, use Inquiry Card, page 247

GEAR SHAVING NOW

Much Faster and More Flexible


1 Sequence plate carrying master cams.
2 Up-feed scale which may be viewed through the observation window.
3 Manual up-feed control for machine set-up.
4 Release clutch (automatic to manual up-feed).

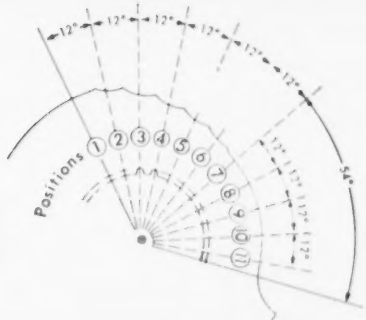
Model GCU with table set for diagonal shaving, showing the elements of the differential up-feed mechanism.

When Automatic Differential Up-feed and Conventional Crowning were added to the Red Ring Model GCU, shaving speed, flexibility and economy were all significantly increased.

AUTOMATIC DIFFERENTIAL UP-FEED

This efficient device provides for the first time an automatic cycle applicable to both diagonal and conventional shaving. This cycle is controlled by an eleven-position master cam. Included are backlash take-up, infeed cutting strokes, idling strokes and return to unloading backlash. The entire cycle or any portion of it may be used depending on job requirements.

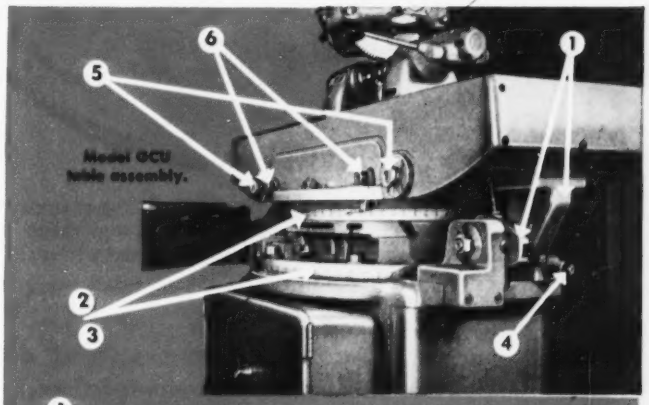
The cam itself does not actuate knee movement. It is strictly a stepped gaging device. Consequently every knee movement is positive, extremely precise and very fast. No danger of operator's errors. Perfect accessibility for fast loading and unloading.



One of the two control cams carried by the feed unit sequence plate.

CROWNING

Gears being shaved conventionally can be crowned by rocking the table about a central pivot during the automatic cycle. The cam controlling the rocking movement is located on table centerline to avoid any tendency to twist. This device also provides for taper shaving.


Model GCU table assembly.
1 Crowning cam and bracket.
2 Scales for diagonal shaving set-up.
3
4 One of 2 tapered shot bolts used to realign table and ways for conventional shaving.
5 Lock pins when removed, permit table to rock for conventional crowning.
6 Bolts operated from the front of the machine actuate tapered wedges to lock table to the ways.

Write for Bulletin S53-7 for full details.

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

6585

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Just as jet pilots are specialists in precision flying at super speeds, so is the Vinco gearing personnel specialists in analyzing, inspecting and producing aircraft gears and gears having more liberal tolerances.

YOU PROFIT. Gears from 24 up to 12 pitch are ground with amazing speed and accuracy on machines designed, made and used only by Vinco; and TIME SAVED is MONEY SAVED. Additional grinding equipment will accommodate gears up to 24" dia., 1 pitch.

VINCO MASTER GEARS are recommended as a means of accurately determining the composite error in production gears. They are the standard for inspection from coast to coast.

VINCO CORP., 9113 Schaefer Hwy., Detroit 28, Mich.

VINCO

MILLIONTHS OF AN INCH FOR SALE

Gear Pumps • Master Gears • Commercial Gears
B-1 Formed Wheel Dressers • Spline Gages
Optical Master Inspection Dividing Heads
Camshaft Comparators • Involute Checkers
Precisiondex • Gear Rolling Inspection Fixtures

TRADEMARK OF DEPENDABILITY

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

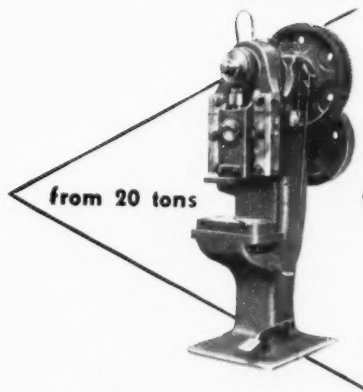
BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 314)

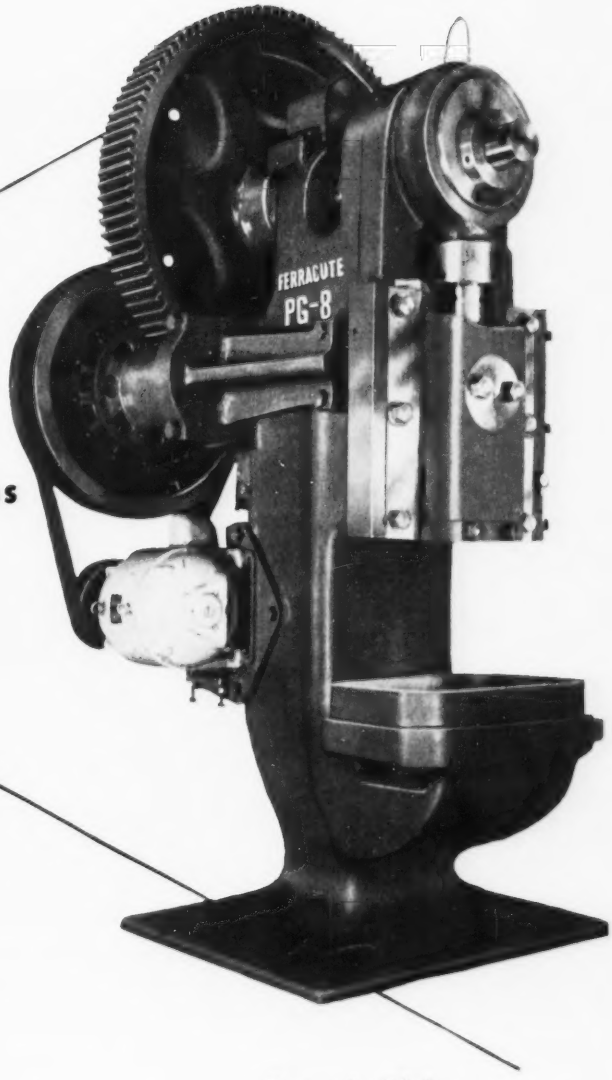
For more information on products advertised, use Inquiry Card, page 247

PICK YOUR "P" PRESS FOR YOUR PURPOSE



from 20 tons

to 200 tons



Ferracute PG-3.
40-ton geared punching press.

Ferracute PG-8.
200-ton punching press.

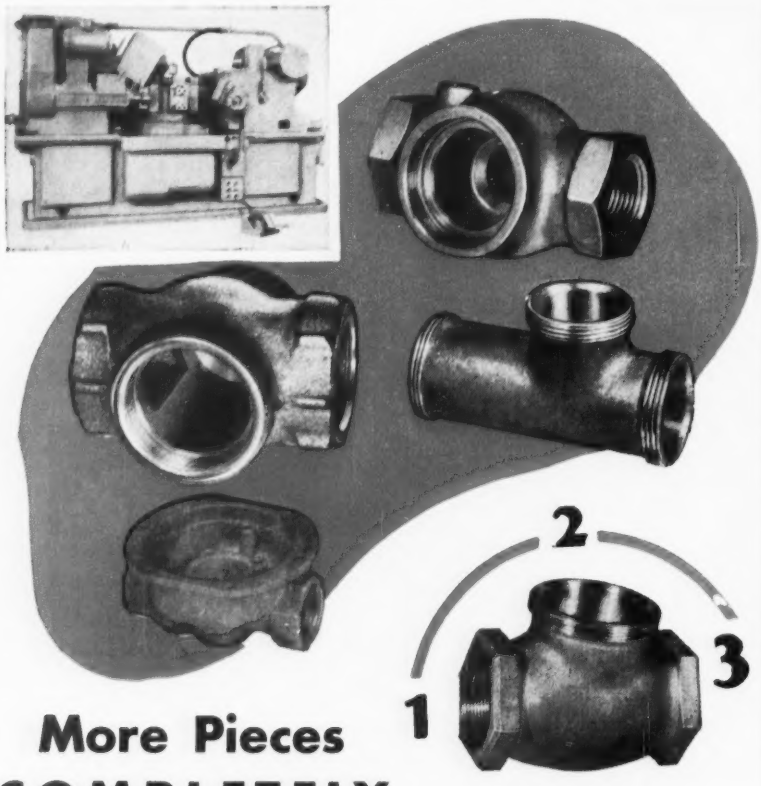
A complete line from 20-tons to 200-tons covering all practical production needs. Available with standard clutch or with air-operated, electrically-controlled FRICTION CLUTCH. Adjustable for continuous or single-stroke operation. Write or wire for full details.

Immediate Delivery **on many sizes with standard clutch.**

FERRACUTE
Since 1863

MACHINE COMPANY

Manufacturers of Power Presses and Special Machinery • BRIDGETON, NEW JERSEY, U.S.A.



More Pieces COMPLETELY *finished in less time on* GOSS & DeLEEUW AUTOMATIC CHUCKERS

This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling.

The "1-2-3" exclusive Goss & De Leeuw feature provides for finish machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

●

Send for illustrated literature which fully describes this recent Goss & De Leeuw development in chuckers. Submit samples of your work for time and cost estimates.

GOSS & DELEEUW
QUALITY PRODUCT-QUANTITY STOCKED

GOSS *and* DE LEEUW
MACHINE COMPANY, *KENSINGTON, CONN., U.S.A*

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle

Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller

Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

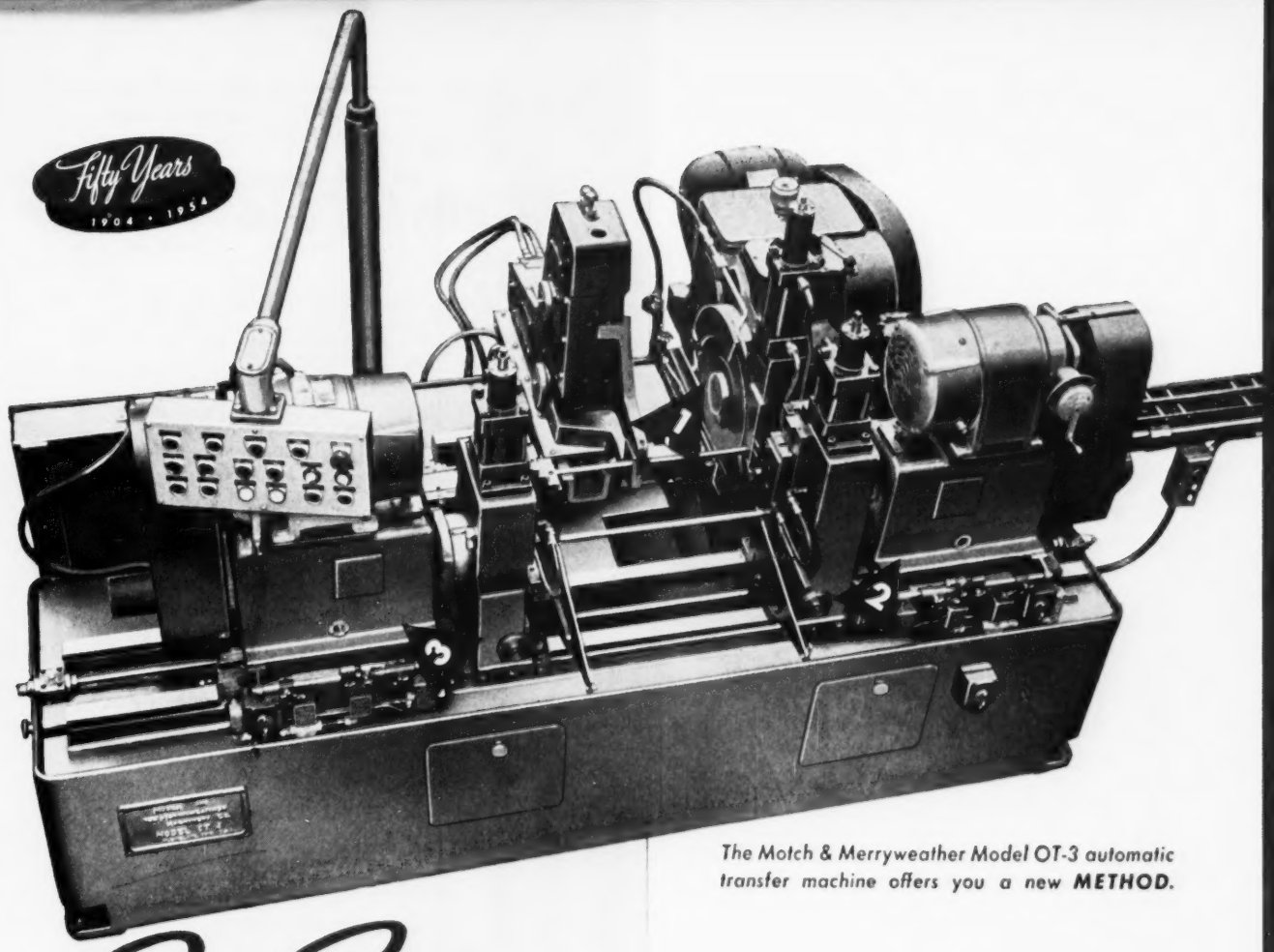
BELTING, TRANSMISSION

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page* 316)

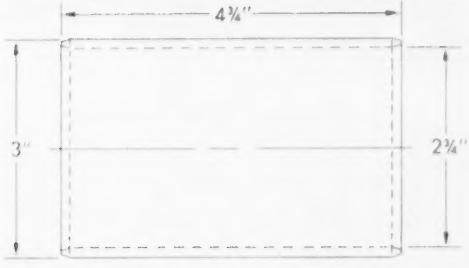
For more information on products advertised, use Inquiry Card, page 247

Fifty Years
1904 • 1954

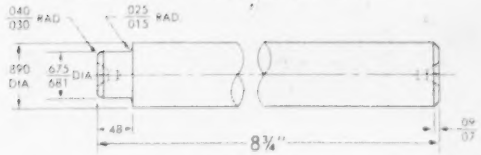


The Motch & Merryweather Model OT-3 automatic transfer machine offers you a new **METHOD.**

Buy Profits – PUT 3 HEADS TO WORK SIMULTANEOUSLY!



OPERATION: Cut off, chamfer inside and outside, and face.
MATERIAL: SAE 1020 steel tubing.
PRODUCTION: 140 pieces per hour.



OPERATION: Cut off, turn radius, chamfer and center drill one end; chamfer and center drill opposite end.
MATERIAL: SAE 1020.
PRODUCTION: 288 pieces per hour.

MP/SF
Most Production per Square Foot

Cut off to square, accurate, milled-finish lengths and double-end machine your work continuously, and simultaneously. Bore, face, chamfer, center drill, turn, ream, or groove singly or in combination. Cut-off time is virtually free. Save labor; save tooling, time, overhead, floor space.

THE MOTCH & MERRYWEATHER MACHINERY CO.

CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

SUPER
Standard Carbide Reamers
In Stock! All Types!
STC
Regular Tip
Flute-Long Tip
Solid Carbide
Shell Type
Jobbers Type
RH & LH Spiral
Expansion Type
Spiral Flute Stub
Straight Flute Stub
Straight Flute Solid Carbide
Ask for Standard Carbide Reamer Circular No. 542 for complete data and net prices. Special reamers also made promptly to your specifications.
Visit our Booth No. 623
Philadelphia
QUALITY CARBIDE TOOLS
Super
TOOL COMPANY
21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Los Angeles 3, California

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York Pa.
Pines Engineering Co., Inc., Aurora, Ill. (Hydraulic)
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Wallis Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BLUING LAYOUT
Dykem Co., 2303 P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

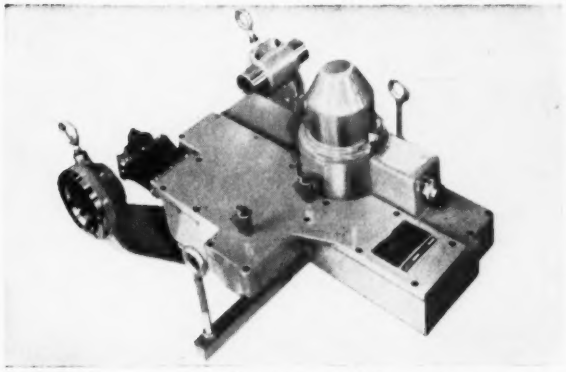
BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot
O. K. Tool Co., Milford, N. H.

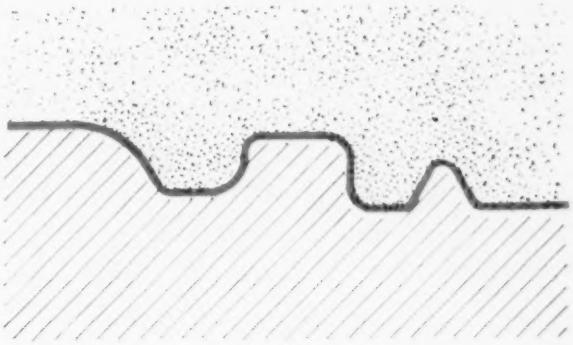
(*Continued on page* 318)

For more information on products advertised, use Inquiry Card, page 247

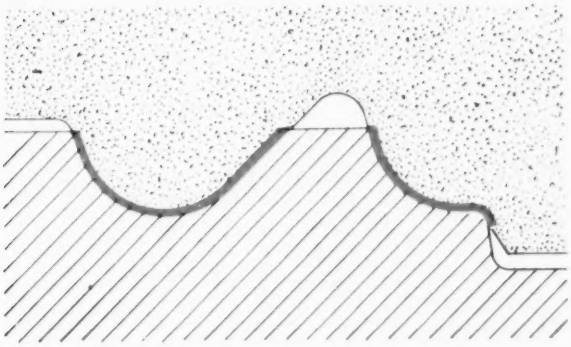
Key to Accurate, Fast Contour Grinding . . . A HOGLUND Automatic or Manual Dresser



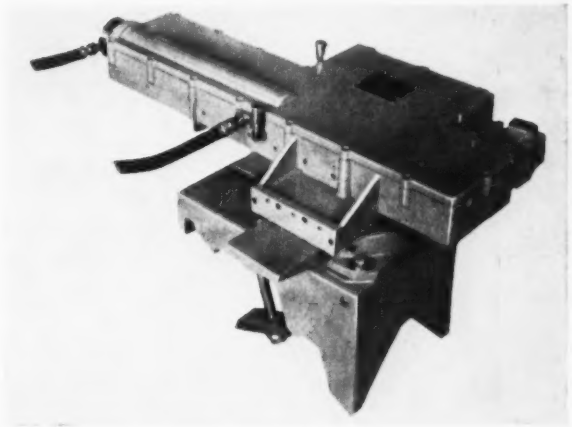
Automatic Electrically Operated Dresser, **Model 40, designed to support between the centers of the grinder under the same conditions as the work piece is supported. Especially suited for grinding machines not having space anywhere else for mounting the dresser.**



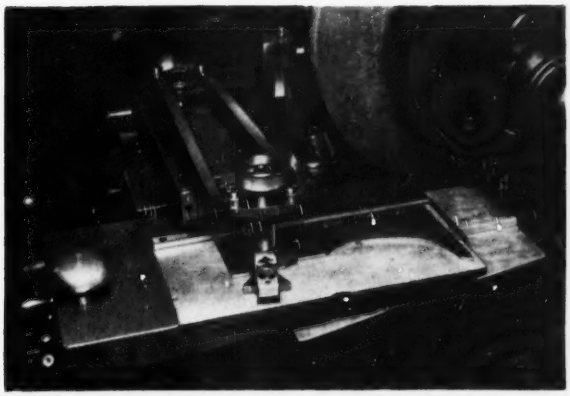
Turbine Shaft Profile **dressed with Hoglund Model 40 Dresser on grinder having just sufficient capacity to hold length of the shaft. Would be extremely difficult to dress without the Hoglund Dresser.**



Double Ball Race Form **on large propeller shaft plunge ground to .0001" tolerance for preload assembly of propeller in hub. Very difficult to dress into the grinding wheel without the Hoglund Model 35 Dresser.**



Automatic Hydraulically Operated Dresser, **Hoglund Model 35, used on large cylindrical grinder for dressing double ball race form and other contours to .0001" tolerance on 30" diameter, 3½" wide wheels.**



Manually Operated Contour Wheel Dresser **for flat table universal cylindrical grinders, operated from template enlarged 10 times or 5 times the size of the finished profile. Hoglund Model KB 14-1 or KB 14-2.**

We make over 50 different types of contour wheel dressers covering all types of grinders —Surface Grinders, Cylindrical Grinders both plain and universal, Internal Grinders, Special Double Wheel-Head Grinders, Centerless Grinders, etc.

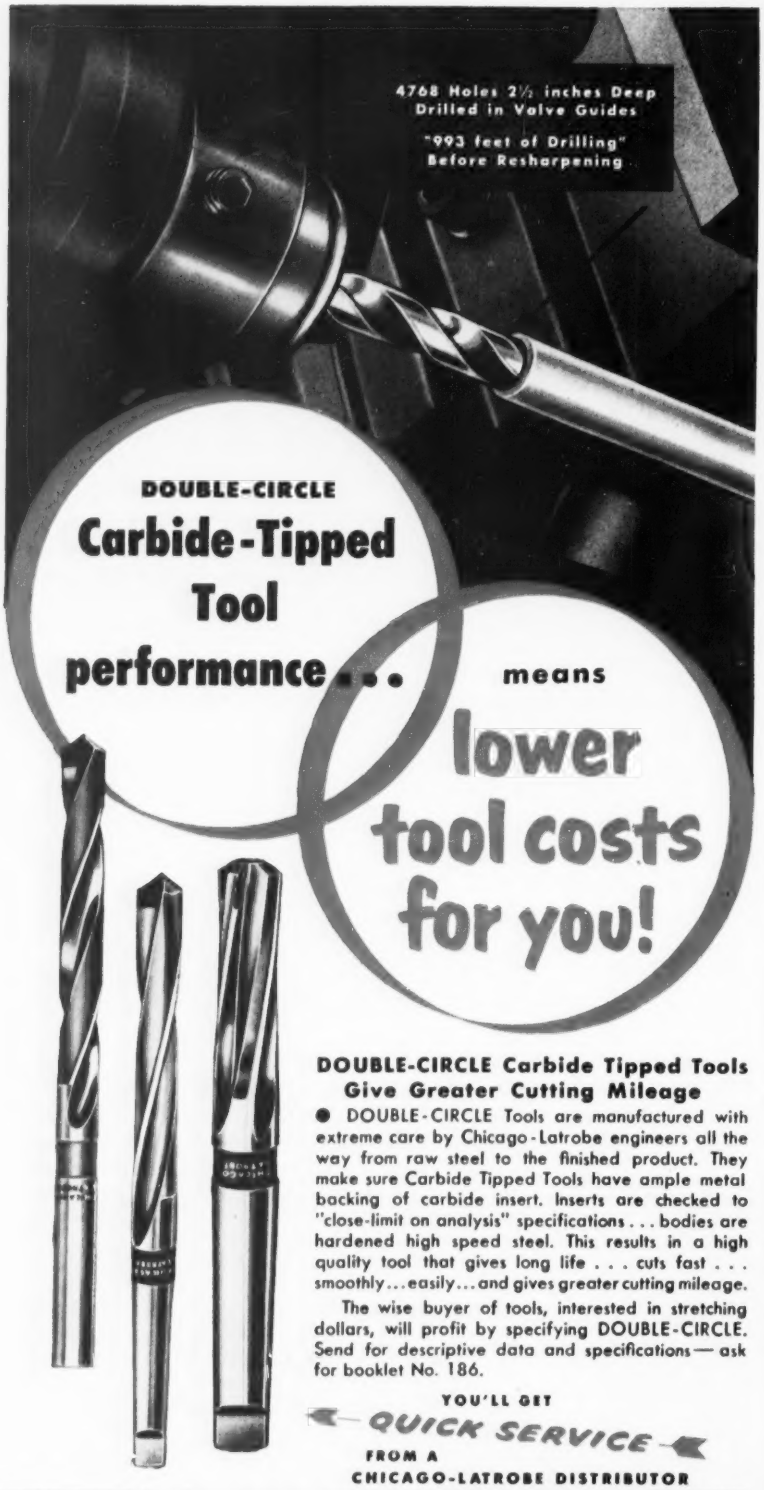
Send us your blueprints and have us submit our recommendations.

HOGLUND

ENGINEERING & MANUFACTURING CO.

Berkeley Heights New Jersey

For more information on products advertised, use Inquiry Card, page 247



DOUBLE-CIRCLE Carbide Tipped Tools Give Greater Cutting Mileage

● DOUBLE-CIRCLE Tools are manufactured with extreme care by Chicago-Latrobe engineers all the way from raw steel to the finished product. They make sure Carbide Tipped Tools have ample metal backing of carbide insert. Inserts are checked to "close-limit on analysis" specifications . . . bodies are hardened high speed steel. This results in a high quality tool that gives long life . . . cuts fast . . . smoothly . . . easily . . . and gives greater cutting mileage.

The wise buyer of tools, interested in stretching dollars, will profit by specifying DOUBLE-CIRCLE. Send for descriptive data and specifications — ask for booklet No. 186.

YOU'LL GET
QUICK SERVICE
FROM A
CHICAGO-LATROBE DISTRIBUTOR

DOUBLE CIRCLE TOOLS

CHICAGO-LATROBE
417 W. ONTARIO ST. CHICAGO 10

DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • CARBIDE TOOLS • SPECIAL TOOLS

BOOKS, Technical
Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., N. Tonawanda, N. Y.

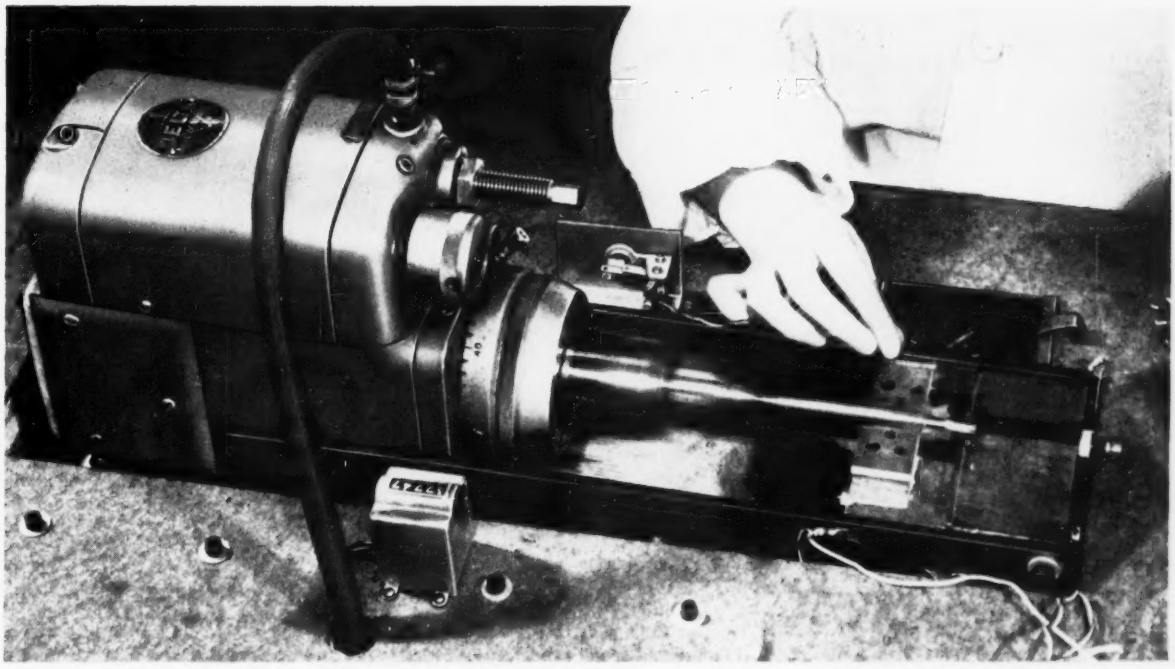
BORING AND TURNING MILLS, Vertical
American Steel Foundries King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal
(Floor, Planer or Table Types)
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kennedy Corp., 1620-A Dime Bldg., Detroit 26, Mich.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.

(*Continued on page* 320)

For more information on products advertised, use Inquiry Card, page 247



Rockwell* Air-Hydraulic DRILL UNIT

→ SAVED $8,000 IN INITIAL COST!
→ SLASHED PART COST 40%!
→ CUT PRODUCTION TIME PER PART 79%!

The Rockwell Air-Hydraulic Drill Unit made possible these very practical results for Radio Receptor Company, Inc., New York City producer of electronic devices. The problem involved the delicate precision assembly of tiny Germanium Diodes, which are rapidly replacing bulkier vacuum type radio tubes in circuits of television sets, electronic computers and radar equipment. Minute tungsten "cats whiskers" had to be "fine squeezed" into sensitive contact with a vertical germanium wafer—*with pressure controlled to tolerances of plus or minus .0002"!*

Very high rejects and slow manual production methods of this operation started alert manufacturing engineers searching for a better way to do it. Original estimates for equipment were in excess of $10,000 per machine—*and then Radio Receptor engineers investigated the Rockwell Drill Unit.*

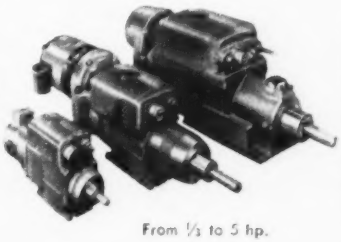
A single purpose machine—incorporating the Rockwell Air-Hydraulic Drill Unit—was devised for only $2,000, an immediate savings of $8,000! But even more important, production jumped from 2,000 to 10,000 units a day, with rejects cut almost to zero—*while cost-per-part was slashed 40%!*

This is just one example—in hundreds of production plants, Rockwell Air-Hydraulic Drill Units have cut costs by cutting waste time, motion and labor out of many varied operations. If you do production drilling, tapping, outside threading, chamfering, hollow milling, counter boring, reaming, centering, or spotfacing, *there is a real probability you, too, can make important savings through improved methods, using Rockwell Drill Units instead of conventional machine tools. Let our Authorized Sales Engineer in your area discuss possibilities with you. He not only offers you engineering counsel, but can also demonstrate right in your plant. Send the coupon today for his name.*

*Originally produced by Rockwell under the trade name "Delta."

Air-Hydraulic **DRILL UNITS**

Another Product by **Rockwell**



From ⅓ to 5 hp.

Drill Unit Division
Rockwell Manufacturing Company
614C N. Lexington Avenue, Pittsburgh 8, Penna.

☐ Please send name of nearest Authorized Sales Engineer.

☐ Please send me latest Drill Unit Catalog.

Name _____
Company _____ Title _____
Address _____
City _____ Zone _____ State _____

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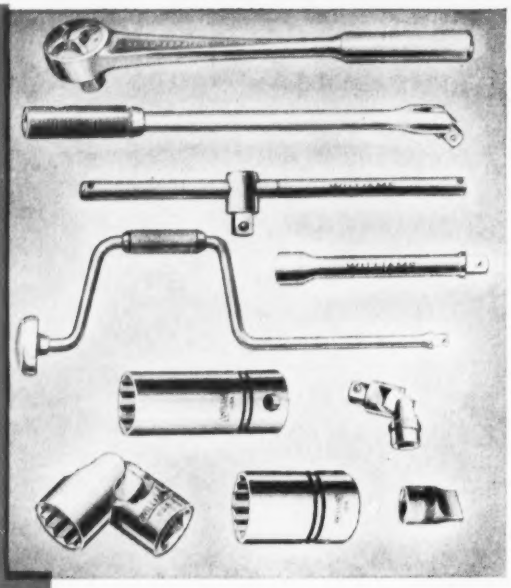
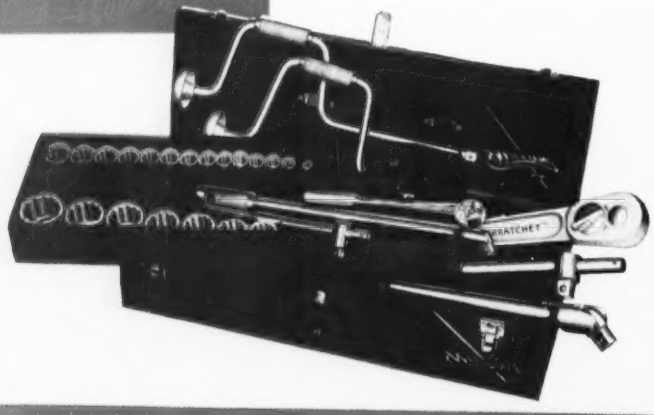
from delicate adjustment to heavy-duty service



... Williams Supersockets

● It's easy to turn out tough jobs faster and better with the right "Supersockets"®. Your Williams Distributor offers you a complete selection of patterns and sets in ¼, ⅜, ½, ¾ and 1" sizes. Also a full line of drivers, handles, ratchets, speeders, adapters, attachments and extensions. All are expertly designed and made from selected alloy steel, heat-treated and chrome-plated. See them in Catalog 201.



WILLIAMS
INDUSTRIAL TOOLS
"The Broadest Line of Its Kind"

PLUS local service from a Williams Distributor

J. H. WILLIAMS & CO. 407 Vulcan Street Buffalo 7, N. Y.

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Mummert-Dixon Co., Hanover, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Toft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kennedy Corp., 1620-A Dime Bldg., Detroit 26, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippit Corp., N. Tonawanda, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.

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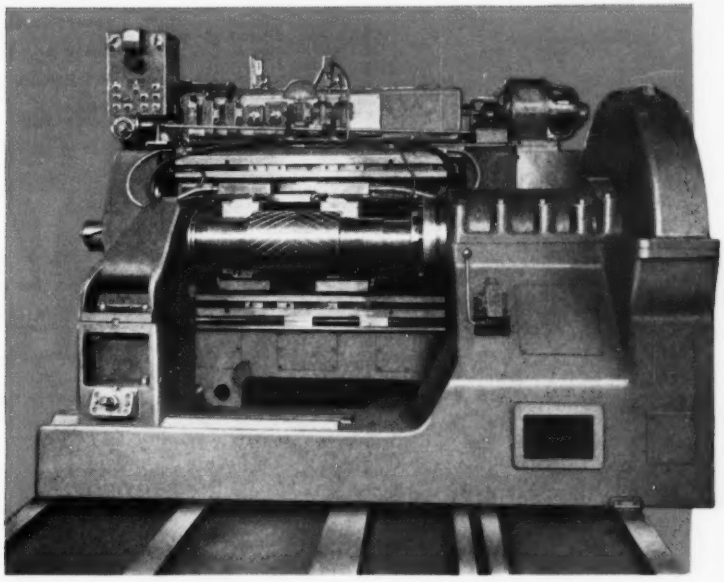
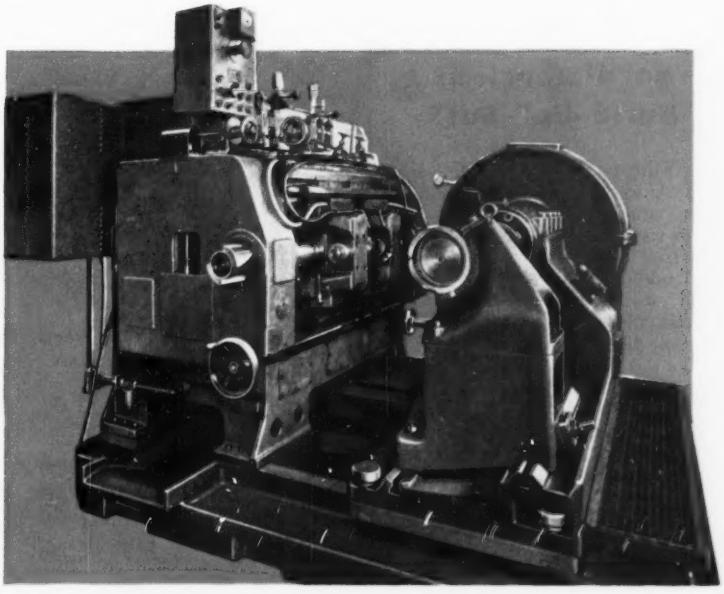


This front view shows start of cutting operation on continuous tooth herringbone pinion with integral shaft. Controls are at upper left within easy reach of operating position.

The new Farrel-Sykes gear machine, the "Twin-Head" generator, cuts gears as much as 33⅓% faster than preceding models, with higher accuracy and finish. This increased speed means fewer man and machine hours, with a resultant substantial decrease in manufacturing costs.

Setup time has also been reduced, and this, together with other conveniences afforded by new design features, contributes to more efficient operation. Rapid selection of speeds and feeds, easy adjustment of

How you can cut your gear manufacturing costs!



Side view, showing the twin cutting heads, left-hand helical guide, operating controls and work saddle.

cutters, easy and positive control of infeed, or depth of cut, are a few examples. On smaller gears the operator has merely to place the blank in position, press the starting button, and remove the gear after the teeth are cut.

Besides these advantages, the "Twin-Head" generator has exceptional versatility. It will cut all types of herringbone gears, single helical and spur gears, two members of a cluster gear simultaneously, and other toothed and cylindrical forms.

Write today for details of this new gear machine.

FARREL-BIRMINGHAM COMPANY, INC.,
ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

Farrel-Birmingham®

FB-900

Save time in gaging large dimensions with this new Ellstrom "Build-Up" Set!

What a time-saver this Ellstrom "Build-Up" Set is when it comes to checking large dimensions to millionths of an inch accuracy! And versatile, too. Six round gage blocks in step series from one to six inches, plus a standard base one-inch high. To use, just select the right combination of blocks and wring them together on the 4" diameter base. Then add standard square or rectangular gage blocks to establish the exact decimal dimensions desired! It's quick, easy, accurate . . . with far less chance of error, and none of the normal hazards encountered in building up large combinations with regular gage blocks. Won't topple over in use . . . and if accidentally knocked over, blocks are held in rigid combination by internal locking screws. Ideal for surface plate checking, setting visual gages or amplifiers, as well as for checking work on planers and horizontal boring mills. And each block is backed by the traditional heritage of Ellstrom . . . *measuring in millionths for three generations.*

Upon Request—New fact-filled catalog containing complete specifications and prices on the entire Ellstrom Standards line. Send for it today!

ELLSTROM STANDARDS DIVISION
Dearborn Gage Company, 22035 Beech Street, Dearborn, Michigan
Originators of Chromium Plated Gage Blocks

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Detroit Broach Co., 20201 Sherwood Ave., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Thor Power Tool Co., Aurora, Ill.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

(*Continued on page* 324)

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National Tool Co.

For These Special Jobs

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

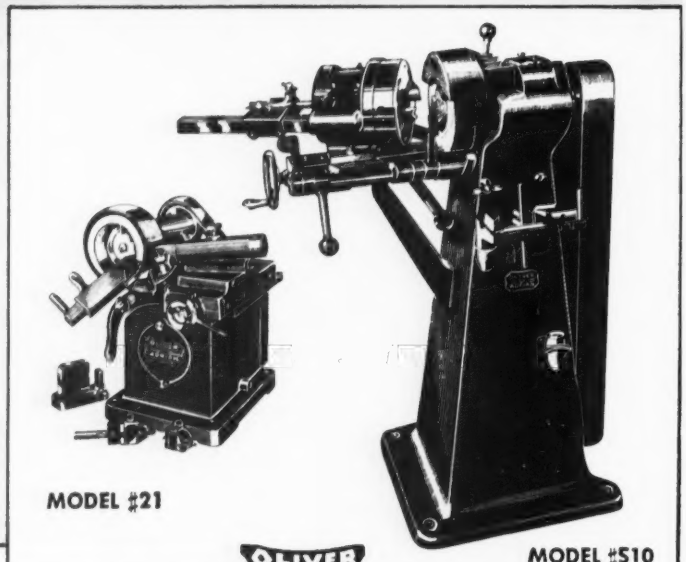
National

TOOL CO.

Cleveland 2, Ohio

ELIMINATE INSPECTION REJECTS
—CAUSED BY IMPROPER DRILLING

MACHINE-GRIND *your* DRILLS
with OLIVER DRILL POINTERS



MODEL #21

MODEL #510

OLIVER OF ADRIAN

Improperly ground drills make imperfect holes . . . cause rejects, production lags and increased costs. Eliminate this unnecessary bottleneck the Oliver Way:

To increase the wearing life and efficiency of your drills, remove them at the first sign of dullness—sharpen them the way that has been proved best . . . with OLIVER DRILL POINTERS.

The balanced cut obtained with OLIVER DRILL POINTERS means that each lip of the drill does equal work—makes more perfect holes.

OLIVER machine-ground drills assure uniformity and . . . they last from 2 to 3 times longer than hand-ground drills.

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.
No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for our free Booklet
"How To Produce More Holes With Your Drills!"
See our catalog in Sweet's Directory

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

Chambersburg Engrg. Co., Chambersburg, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Ptitsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kux Mch. Co., 3930-44 W. Harrison St., Chicago, Ill.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 326)

For more information on products advertised, use Inquiry Card, page 247

THE

Delpark *Junior*

BRINGS

Greater Savings

TO MACHINES WITH 1/4 TO 1 1/2 G.P.M. COOLANT FLOW

Greater savings through better finish, greater accuracy and more production are possible with the DELPARK Junior Coolant Filter on machines with low coolant flows.

Newest in a famous line, the DELPARK Junior now brings to the machine with small coolant flow, individual filtration with all the efficiency of the larger DELPARK Automatic Filter.

SAVINGS? . . . There are savings in the low cost DELPARK Junior . . .

—*Savings* in greater accuracy and better finish through free-cutting wheel or tool action . . .

—*Savings* in greater machine efficiency and production . . .

—*Savings* in labor and material . . .

—*Savings* in rejects . . .

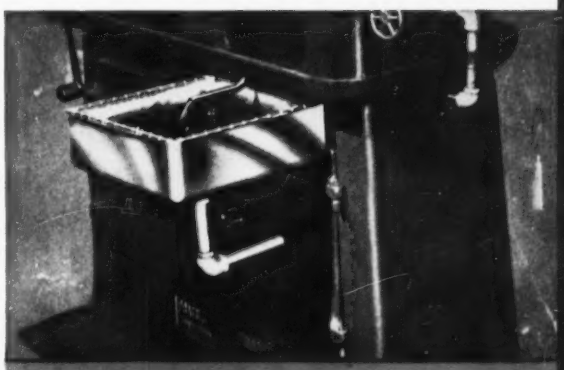
—*Savings* in grinding wheels and tools . . .

—*Savings* in maintenance and machine parts . . .

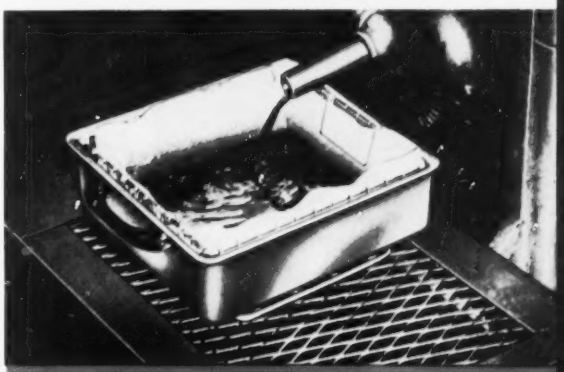
—*Savings* in coolants . . .

—and *Savings* in numerous other production and operation phases.

Write today for the new DELPARK JUNIOR BULLETIN.



Delpark Junior installation on your holder. Coolant flows through tray and returns to machine through lower pipe.



Delpark Junior serving small grinder. Unit rests on top of coolant tank and releases filtered coolant into reservoir.

Delpark

INDUSTRIAL FILTRATION

Backed by more than 30 years experience in Industrial Filtration

INDUSTRIAL FILTRATION COMPANY, 15 INDUSTRIAL AVENUE, LEBANON, INDIANA

precise manufacturing produces...

Quality Supreme BRAND Chucks

Interchangeable with other makes . . . entire body hardened inside and out for greater durability . . . jaws nickel chrome moly alloy steel . . . one piece geared nut construction. The economical chuck to use.

SUPREME PRODUCTS, INC., 2222 S. Calumet, Chicago 16, Illinois

the chuck that lives up to its name ... Supreme

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, IRON
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Hansell-Elcock Co., 485 W. 23rd Place, Chicago 16, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

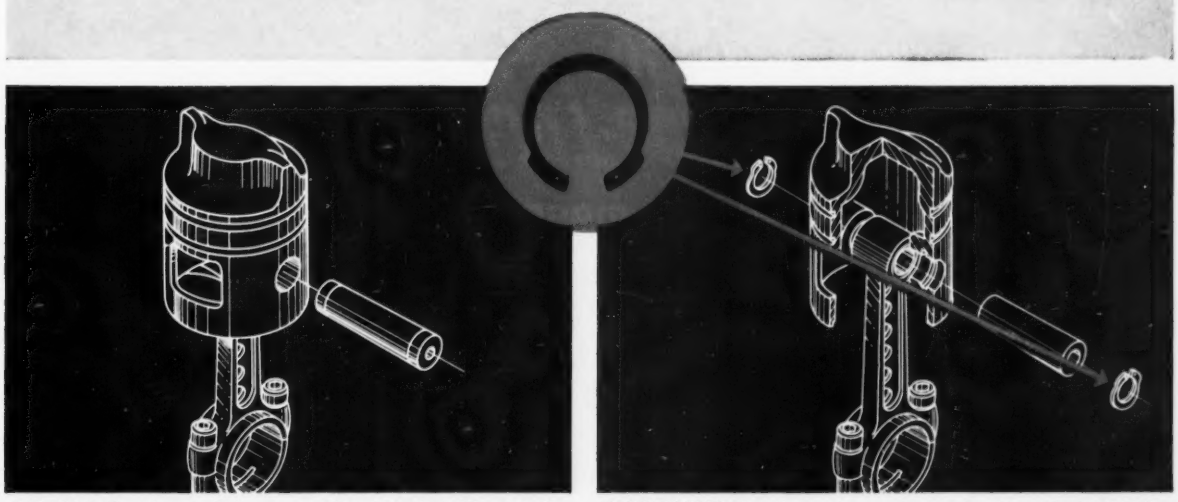
CENTERING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page 328*)

For more information on products advertised, use Inquiry Card, page 247

2 Waldes Truarc Rings Replace 2 End Plugs ...Eliminate 3 Operations...Save $.066 Per Unit



OLD WAY Two inserted-plug type wrist pin locks hold wrist pin in place. 3 operations involved: costly machining, pressing in place, post-assembly machining. Costly maintenance problem—resulting from end plugs hammering loose.

TRUARC WAY Two Truarc Inverted Retaining Rings (Series 5008) hold wrist pin in place. Truarc Rings snap into grooves easily cut in piston, provide positive lock . . . practically eliminate maintenance costs. Quick assembly, disassembly.

Titan Chain Saws, Inc., Seattle, Washington, uses 2 Waldes Truarc Rings to replace old-style inserted-plug type wrist pin locks in their Titan chain saws. Use of Waldes Truarc Retaining Rings eliminates 2 press fit end plugs. Machining of plugs, pressing in place, finish machining—no longer required. Truarc way holds rejections to a minimum. Unit efficiency is greatly increased.

Redesign with Truarc Rings and you, too, will cut costs. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better job of holding parts together.

USE OF 2 WALDES TRUARC RINGS PERMITTED THESE SAVINGS PER UNIT:

OLD WAY	
Cost of 2 end plugs Cost of pressing in and machining	$ .169
TRUARC WAY	
Cost of grooving piston Cost of 2 Truarc Rings	.103
Saving per Unit	**$ .066**

Waldes Truarc Rings are precision-engineered . . . quick and easy to assemble and disassemble. Always circular to give a never-failing grip. They can be used over and over again.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

For precision internal grooving and undercutting . . . Waldes Truarc Internal Grooving Tool.

"Visit the Truarc Exhibit at the I.R.E. Show, Booth 746, March 22-25"

SEND FOR NEW CATALOG

WALDES

TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,410,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,308; 2,509,081 AND OTHER PATENTS PENDING.

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send me the new Waldes Truarc Retaining Ring catalog. M-03½

(Please print)

Name .....

Title .....

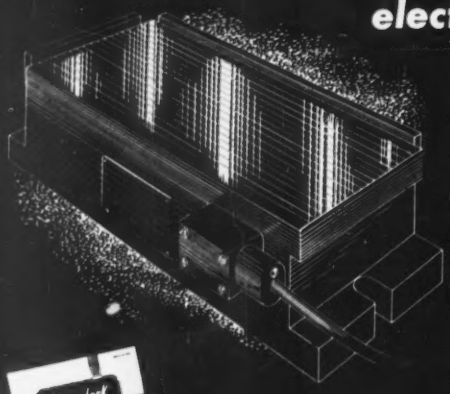
Company .....

Business Address .....

City ..... Zone ..... State .....

SMALL CHUCKS
FOR THOSE SMALL JOBS...

it's Magna-Lock electro-magnetic CHUCKS



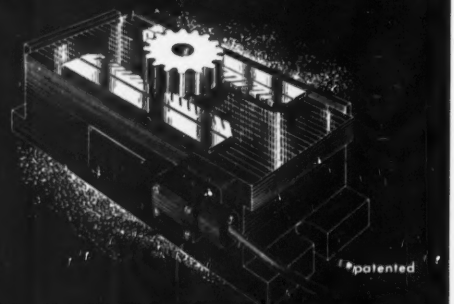
5" x 10"... 6" x 12"... 6" x 18" working surfaces. Ideal for bench work, small machine tools. 22% more holding power . . . moisture proof . . . other advantages of larger Magna-Lock Chucks. Complete with rectifier and switch for operation on A.C. voltage.

Price: 5 x 10 ..... $125.00
6 x 12 ..... 159.00
6 x 18 ..... 225.00
IMMEDIATE DELIVERY.

Get details... WRITE DEPT. M-34

...AND FOR NON-MAGNETIC MATERIALS | it's Magna-Vise ★

HOLDS fibre, brass, copper, plastic, others. Increases versatility of your magnetic chucks. Send for facts.



Magna-Lock is first to increase your machine's productivity

Hanchett MAGNA-LOCK CORPORATION
Magnetic Chucks and Devices
Magna-Lock
BIG RAPIDS, MICHIGAN, U. S. A.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Thor Power Tool Co., Aurora, Ill.

CHUCKING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(*Continued on page 330*)

Now A Beaver QUICK-CHANGE HOLDER With...

DIXI Boring Mill
CLEARMAN Boring Mill
OERLIKON Boring Mill
DE VLIEG Boring Mill
MILES Boring Mill
REED PRENTICE Boring Mill
BLOOM-QUIST ECK Boring Mill
GIDDINGS & LEWIS Boring Mill
UNIVERSAL Boring Mill
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PEGARD Boring Mill
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OHIO Boring Mill
LANDIS Boring Mill
LUCAS Boring Mill
FORGES DE GILLE Boring Mill
CINCINNATI-GILBERT Boring Mill
CINCINNATI BICK FORD Boring Mill

PORTAGE Boring Mill
CERUTI Boring Mill
YODER Boring Mill
P. HURE Boring Mill
CASSAR Boring Mill
CARLTON Radial Drill Press
FOSDICK Radial Drill Press
ASQUITH Radial Drill Press
AVEY Drill Press
BAKER Drill Press
WESTERN Radial Press
CINCINNATI Hole Hog Drill Press
AMERICAN Radial Hole Wizard Drill Press
NILES Radial Drill Press
KAUKAUNA Radial Drill Press

New adaptable Morse Taper Shank and Adaptor Plug

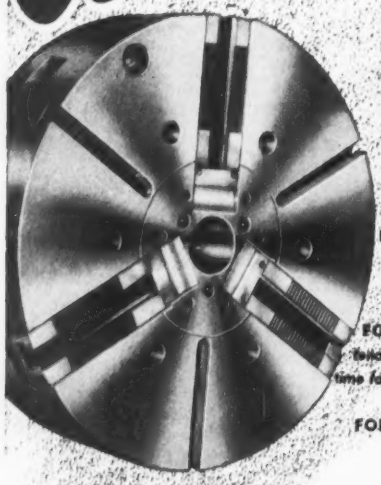
With this new shank and adaptor plug Beaver has developed a holder that is adaptable with the proper plug to 98% of American and foreign made machine tools equipped with No. 5 or No. 6 Morse Taper Sockets.

WE'LL SEE YOU AT BOOTH 517 A. S. T. E. SHOW

Beaver TOOL AND ENGINEERING CORPORATION

BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648

Whiton AIR CHUCKS



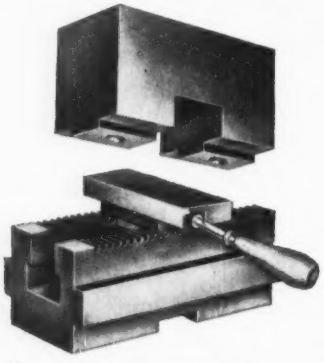
Equipped with American Standard Serrated Jaws and Whiton Micro Jaw-Sets

FOR INCREASED PRODUCTION with less operator fatigue. Faster spindle speeds with safe, fast chucking of work.

FOR PRECISION ADJUSTMENT of chuck jaws. Maintenance of jaw settings during long runs. Less down time for adjustment.

FOR STANDARDIZED WORK-HOLDING EQUIPMENT

Whiton Air Chucks are engineered to give maximum efficiency and economy of operation. Sizes up to 12" are wedge-actuated for high speed spindle rotation. Larger sizes up to 36" are lever-actuated to give maximum holding power with minimum air consumption. Chuck body and jaws are made of selected steels and heat treated for strength and durability.



Whiton MICRO JAW-SET

An exclusive Whiton feature which, in combination with the American Standard Serrated Jaws, gives Whiton Chucks the rigidity of a non-adjustable chuck and provides for extremely precise individual jaw adjustment.

See us at Booth No. 508—A.S.T.E. Exposition Philadelphia—April 26th to 30th.

Whiton SINCE 1856

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton, E., & Son Co., Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.

CHUCKS, Lathes, Etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Horton, E., & Son Co., Windsor Locks, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CLAMPING APPLIANCES FOR MACHINE TOOLS

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

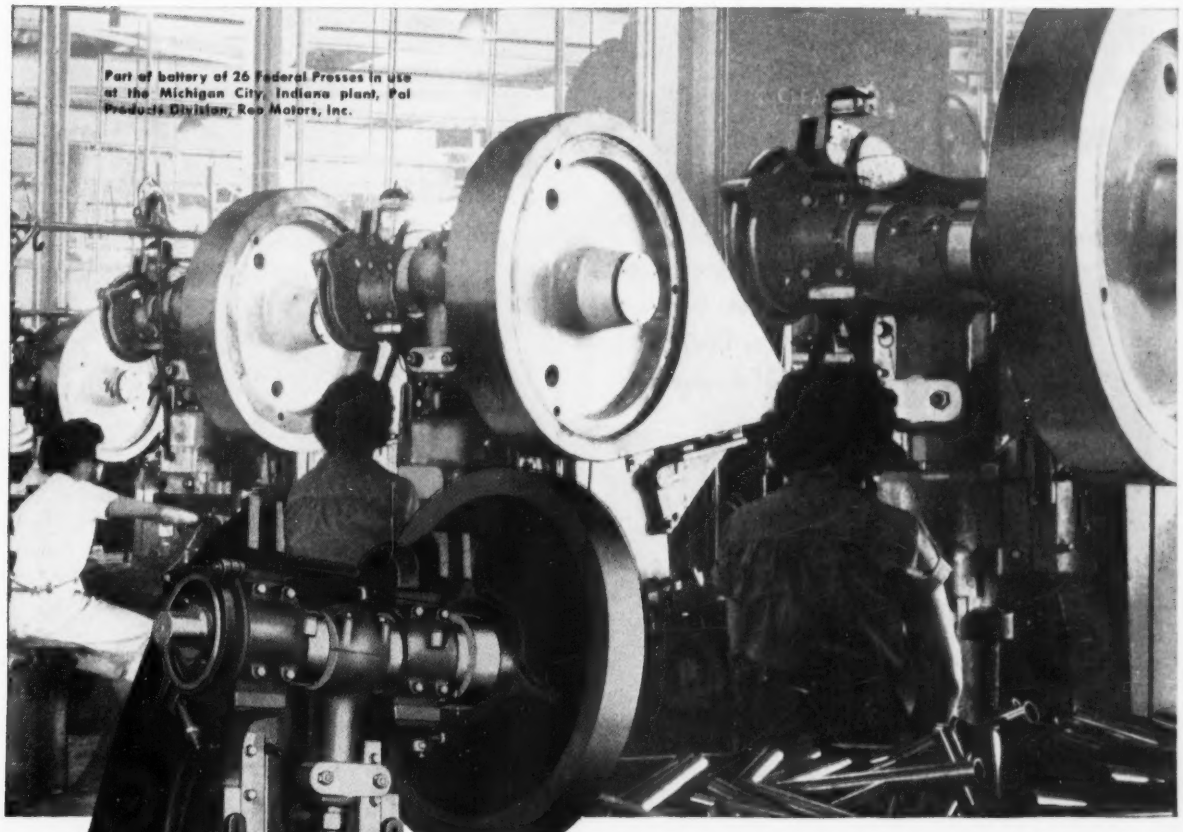
CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.

(*Continued on page* 332)

For faster, safer, better presswork

LEADING MANUFACTURERS LOOK TO FEDERAL...



Part of battery of 26 Federal Presses in use at the Michigan City, Indiana plant, Pal Products Division, Reo Motors, Inc.

No. 7 Standard Press
Capacity, 80 tons

...FEDERAL Open Back Inclinable PRESSES

Here's another leader who relies on Federal Presses to speed production, eliminate accidents, maintain high quality. These rugged presses are precision-built and embody the finest materials and workmanship. Offered in four major classes—Standard, Dial Feed, High Speed and Special presses—in a wide range of sizes. Next time you buy choose Federal and get the *extra quality* that means long-life, low maintenance. Write for catalog.

FEDERAL PRESS COMPANY
505 Division Street Elkhart, Indiana

MODEL J
(Wet or Dry)
10" x 18" Capacity

Check its

✓ CAPACITY
✓ STRENGTH
✓ 3-Point Suspension
✓ Safety
✓ Centralized CONTROL

and You'll buy a

JOHNSON BAND SAW

MODEL B
5" x 10" Capacity
Light—Portable

WRITE FOR DETAILS

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co. Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd, Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

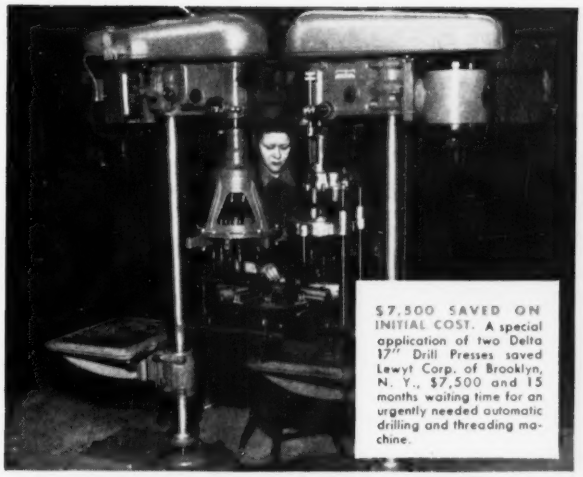
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

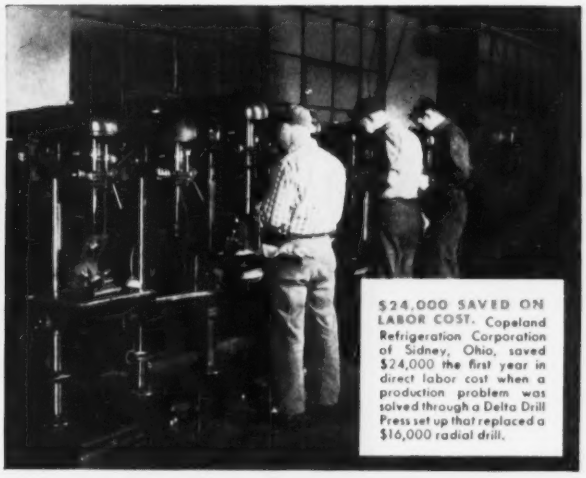
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping)
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

(*Continued on page* 334)

For more information on products advertised, use Inquiry Card, page 247

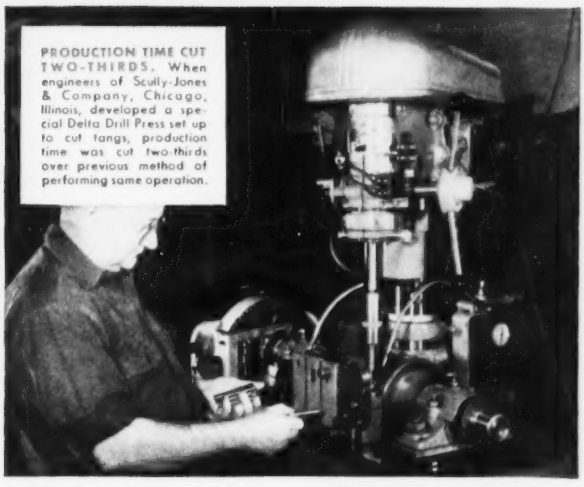


$7,500 SAVED ON INITIAL COST. A special application of two Delta 17" Drill Presses saved Lewyt Corp. of Brooklyn, N. Y., $7,500 and 15 months waiting time for an urgently needed automatic drilling and threading machine.



$24,000 SAVED ON LABOR COST. Copeland Refrigeration Corporation of Sidney, Ohio, saved $24,000 the first year in direct labor cost when a production problem was solved through a Delta Drill Press set up that replaced a $16,000 radial drill.

MATERIAL HANDLING COSTS SLASHED. Sangamo Electric Company, Springfield, Illinois, eliminated costly trucking and handling through use of Delta sectional table drill press set ups, with operator moving from one machine to another.



PRODUCTION TIME CUT TWO-THIRDS. When engineers of Scully-Jones & Company, Chicago, Illinois, developed a special Delta Drill Press set up to cut tangs, production time was cut two-thirds over previous method of performing same operation.

Four Basic Problems: ONE SENSIBLE ANSWER

(Rockwell-built DELTA Power Tools can be your answer to rising costs, too!)

If your profits are being squeezed between rising costs and stiffening competition, do what other progressive businessmen are doing. Use low-cost Delta Power Tools to supplement—and sometimes replace—heavy, expensive conventional machine tools.

Rockwell-built Delta Power Tools make possible big savings in labor, time, and material handling costs because they are so easy to move into and out of production lines, and set up in special combinations. They work to extremely close tolerances, and *stay* accurate, require a minimum of maintenance. Parts are quickly available. And Delta Power Tools are so inexpensive that they make money for their owners *even when standing idle.* They can be *kept* tooled up, saving costly set-up time.

The growing trend toward low-cost, portable, accurate Delta Power Tools amounts to virtually a "new Industrial revolution"—a new kind of production thinking that is cutting costs in plant after plant. Your Delta dealer can help you cut *your* costs, too—he's listed in the classified pages of your phone book under "TOOLS" or "MACHINERY." *Delta Power Tool Division, Rockwell Manufacturing Company, 614C N. Lexington Ave., Pittsburgh 8, Pa.*

DELTA QUALITY MAKES THE DIFFERENCE

ROCKWELL

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

Delta Power Tool Division
Rockwell Manufacturing Company
614C N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send me full information about Delta Power Tools, including Catalog AB-53.

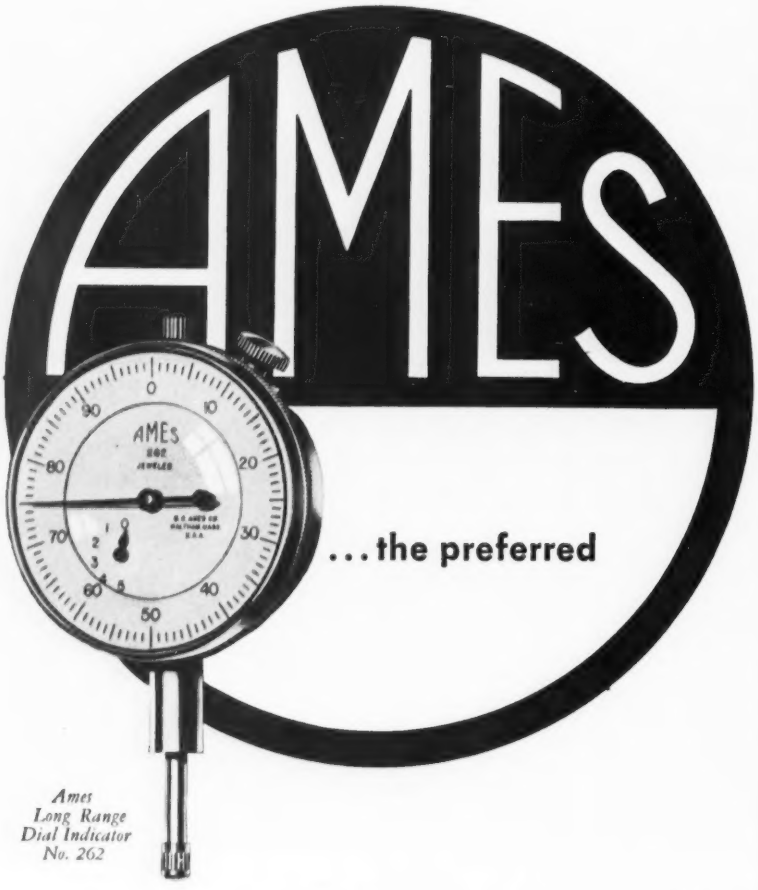
☐ Please send me the name of my nearest Delta dealer.

Name_____

Company_____ Title_____

Address_____

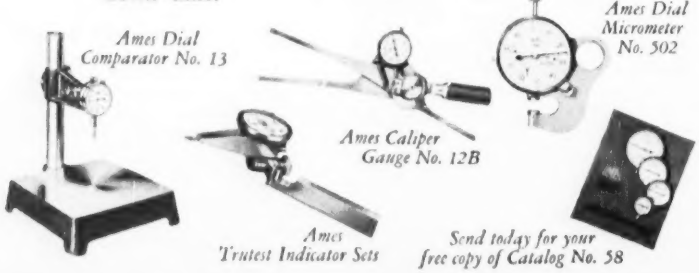
City_____ Zone____ State_____



Ames Long Range Dial Indicator No. 262

... not because they cost more (in the long run they're more economical) but because they're completely *impersonal*. They do their measuring jobs absolutely independent of the human hand.

For more than 50 years, Ames Micrometer Dial Gauges and Indicators have kept pace with increasingly critical precision requirements. Today, each part of every Ames product is carefully built by exclusive Ames methods and machines from the materials best suited to its function — and 100% checked for accuracy. As a result, all Ames products are extremely accurate and sensitive, yet rugged and tough — to give you *longer* service with *less* down-time.



Ames Dial Comparator No. 13

Ames Dial Micrometer No. 302

Ames Caliper Gauge No. 12B

Ames Trutest Indicator Sets

Send today for your free copy of Catalog No. 58

Representatives in principal cities. B. C. AMES CO. *27 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

COMPOUNDS, Resin and Molding

Bakelite Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden, Ave., Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CONTROLS, THERMO

Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

COOLANT SEPARATORS

See Separators, Oil or Coolant.

COUNTERBORES

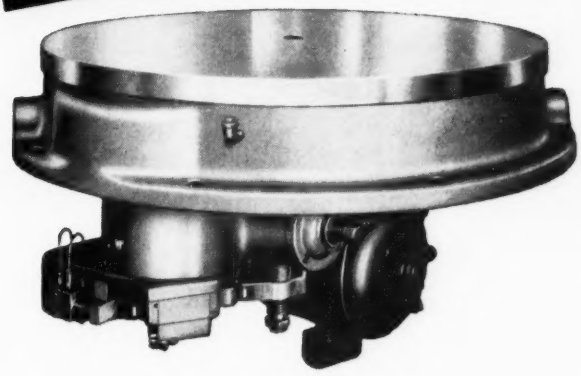
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laure' Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

(*Continued on page* 336)

automatic cam feed units

Avey has both...

automatic index tables



Automatic Index Tables

meet demand for Drilling and Tapping Equipment

Made in sizes 16", 20", 24", 30", 36" and 40" diameter. Indexes, 3 to 100 stations.

These Index Tables are self-contained units, built on unit construction principle and includes motor drive assemblies. All drive and control mechanisms underneath table for free work surface...easy accessibility.

Send for Bulletins

Automatic Cam Feed Units

for Drilling...Tapping...Reaming...
Hollow Milling and Deep Hole Drilling

Vertical, Horizontal or Angular Mounting

Units are universal in application...let us show you their application to your job.

Made in two sizes—No. 1 and No. 2 Morse Taper.

This simple unit gives high production at a lower cost. When used in multiples to complete operations, no relocation of part is necessary, thus producing more accurate work.

Semi-skilled operators will deliver high production accurately and efficiently, yet with a minimum of supervision.

THE AVEY DRILLING MACHINE CO.

Cincinnati 1, Ohio

Avey

SOLVED...

The Problem of Driving the Pump from a Reversing Shaft without Changing Direction of Flow or Port Positions

New Tuthill Catalog No. 105 Provides the Facts You Need on Automatic Reversing Pumps

How to lubricate reversing machinery! How to provide coolant or hydraulic power when the pump must be driven from a reversing shaft! How to insure pump flow in the proper direction on machinery which must be shipped without knowing the ultimate direction of the driving members!

The answers to questions like these are presented in this new Catalog No. 105 on Tuthill Automatic Reversing Pumps. Through a unique feature developed by Tuthill, these pumps can be driven in either direction of rotation without changing direction of flow or port positions. The wide range of types, sizes, and pressures makes these pumps readily adaptable to your requirements. Capacities up to 200 g.p.m. and pressures to 400 p.s.i.

TUTHILL PUMPS FOR THE PURPOSE

Write for your copy of Catalog No. 105 today

TUTHILL PUMP COMPANY

Dependable Rotary Pumps since 1927

939 East 95th. St., Chicago 19, Ill.

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd. Ingersoll, Ontario, Canada

Starrett, The L. S. Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRADLES, Coil

Halpern, Wm., Co., Inc., 100 Stevens Ave., Mt. Vernon, N. Y.

CRANES, Electric Traveling

Cleveland Crane & Engrg Co., Wickliffe, Ohio.
Morgan Engrg Co., Alliance, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.

(*Continued on page 338*)

For more information on products advertised, use Inquiry Card, page 247

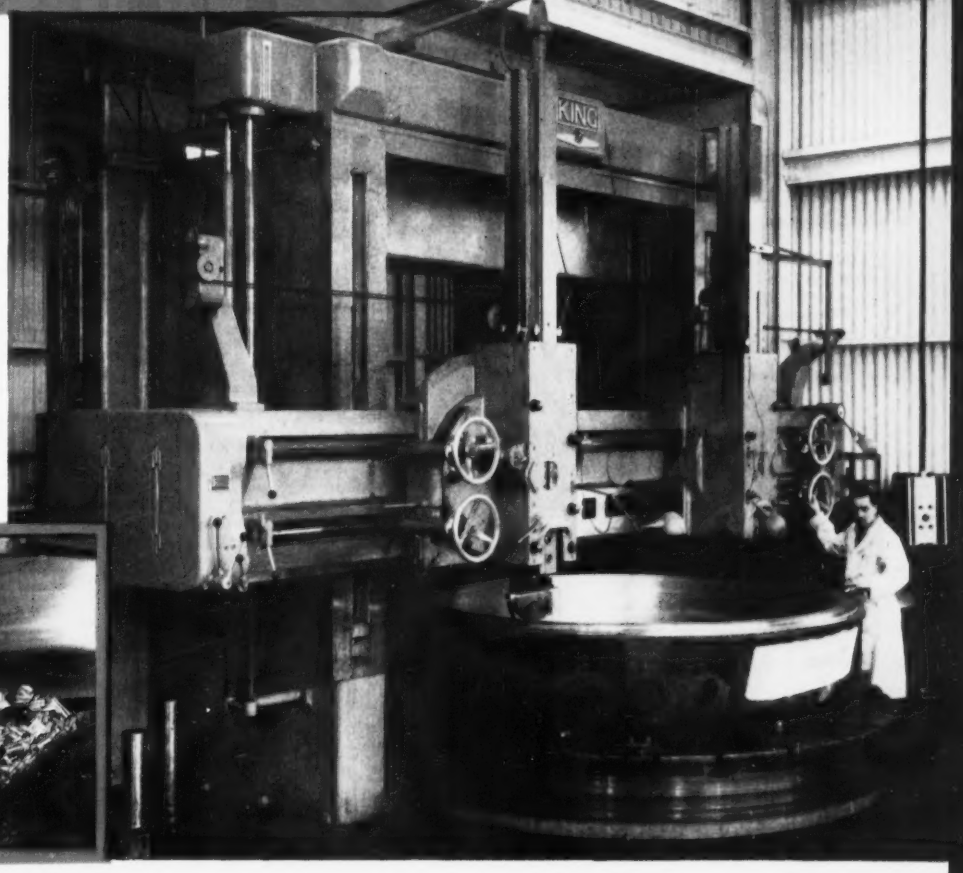
New KING VERTICAL BORING & TURNING MACHINE

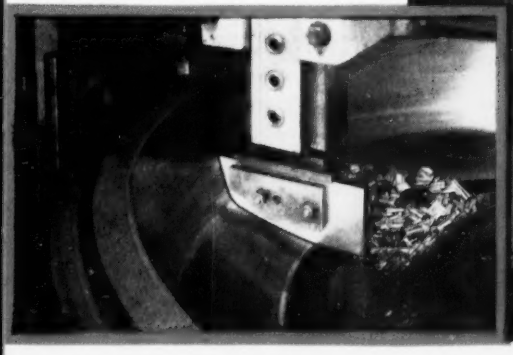
at THE AKRON STANDARD MOLD COMPANY

Machines "KING SIZE" Tire Molds

25% Faster!

At right — "Akron's" 120" KING machining huge tire mold. *Below*— Close-up view showing forming cut being taken in the mold, amply demonstrating KING "heavy-weight" power and rigidity.





The Akron Standard Mold Company of Akron, Ohio, a KING® Vertical Boring & Turning Machine customer of long standing, recently purchased the 120" KING shown above for manufacturing giant-size tire molds. The mold being machined is size 30.00 x 33, the largest size mold this company has made to date — so large, in fact, that the forming tool had to be made in three separate pieces in order to complete the contour.

Mr. W. P. Voth, President of The Akron Standard Mold Company, reports this new KING "amply fulfills our requirements . . . and turns out work even faster than we anticipated." Mr. Voth estimates that this new KING has increased production on large size molds by 25%.

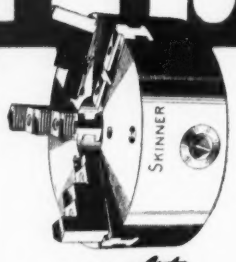
Here is more on-the-job evidence of typical KING performance . . . the kind of evidence that explains why KING today, as in the past, is industry's logical first choice for fast, accurate, profitable production. KING Machines are made in 10 sizes, 30" to 144", in a wide variety of head combinations. See your KING Distributor, or write to us direct, for complete specifications and illustrated description of construction features.

American Steel Foundries

KING MACHINE TOOL DIVISION

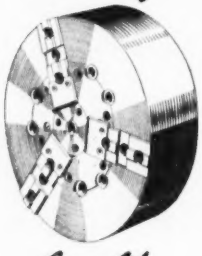
1150 TENNESSEE AVENUE CINCINNATI 29, OHIO

SKINNER



quality

accuracy



long life

positive grip

SCROLL CHUCKS Self-centering models for light, medium and heavy duty jobs in tool room or for production runs. Available in sizes from 3" to 18" with semi-steel or forged steel bodies, and heat-treated alloy steel for all other parts. Provided with two sets of solid jaws or two-piece jaws for holding internal or external work. Lands on the jaw, jaw steps and end bites are ground after the chuck is assembled.

INDEPENDENT CHUCKS Models for medium and heavy duty tool room and general machine shop work. Available in sizes from 4½" to 36" with semi-steel, steel, or forged steel bodies. All other parts are heat-treated alloy steel. Jaws are solid reversible or two-piece with reversible tops for either internal or external gripping. The body surrounds more than 60% of each operating screw for the full length of the screw to assure proper alignment at all times.

AIR & POWER CHUCKS Self-centering models for heavy duty production work on engine and turret lathes and automatics. Sizes from 6" to 24" with forged steel bodies, and with either 2 or 3 jaws are available. The wedge angle is such that work is gripped positively regardless of jaw position. The chuck will not release the work, even if air line is broken, until operator actuates draw bar. Skinner also has a complete line of power chucking accessories.

MACHINE VISES Skinner vises are accurate, fast acting and positive gripping. Series DPV wrench-operated Vises have semi-steel body and hardened and ground work holding surfaces. They have all the universal features so necessary for drill press operations. Clamp the work for drilling in one plane — drill — turn the vise on edge for all right angle drilling operations.

Series FS Vises have swivel base for accurate indexing necessary in milling operations. Top of the movable jaw is ground parallel to the base for use as an indicating base for setting cutters, trueing work, etc.

Details on the full line of products are included in Skinner General Catalog — write to the company or your nearest Skinner distributor for a free copy!

THE SKINNER CHUCK COMPANY
206 Edgewood Ave., New Britain, Conn.

THE CREST OF QUALITY

SKINNER CHUCKS

Chucks - Vises

Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429 Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carbolay Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread)
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Willey's Carbide Tool Co., 1340 W. Verner Hwry., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

(*Continued on page* 340)

For more information on products advertised, use Inquiry Card, page 247

Try Butterfield TAPS

Try Butterfield Taps on the job and you'll know what built-in quality can mean in long-run economy.

BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.
TAPS · DIES · DRILLS · REAMERS · COUNTERBORES · SCREW PLATES

FOR BETTER SERVICE
Call Your
BUTTERFIELD
DISTRIBUTOR

Production More Than Doubled

by changing to a

KELLER RIVETER

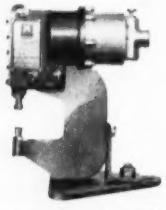
An electronic tube manufacturer boosted production from 62 to 155 pieces an hour by installing a Keller Compression Riveter in place of a kick press for staking the pins in vacuum tube bases. This 150% increase, achieved at relatively small cost, is typical of the results obtained by proper application of Keller Pneumatic Tools.

For riveting, staking, crimping, pressing, and marking operations, and for forcing fragile parts into a pressure fit, Keller Compression Riveters have the tremendous advantages characteristic of air power. They give a squeeze—not a slap—and exert maximum power only at the *end* of the stroke. This reduces shock and spoilage from cracked and broken parts.

Facts in Brief

about

KELLER Compression Riveters



- Air pressure gives a squeeze—not a slap
- Can be operated by foot valve or hand throttle
- Automatic cycle, stops at end of each cycle
- Portable, bench, or pedestal mounting
- Ideal for pressing, dimpling, staking, forcing, or riveting operations

Send for descriptive literature and detailed information

KELLER TOOL COMPANY

GRAND HAVEN, MICHIGAN

Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).
Pines Engineering Co., Inc., Aurora, Ill.

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

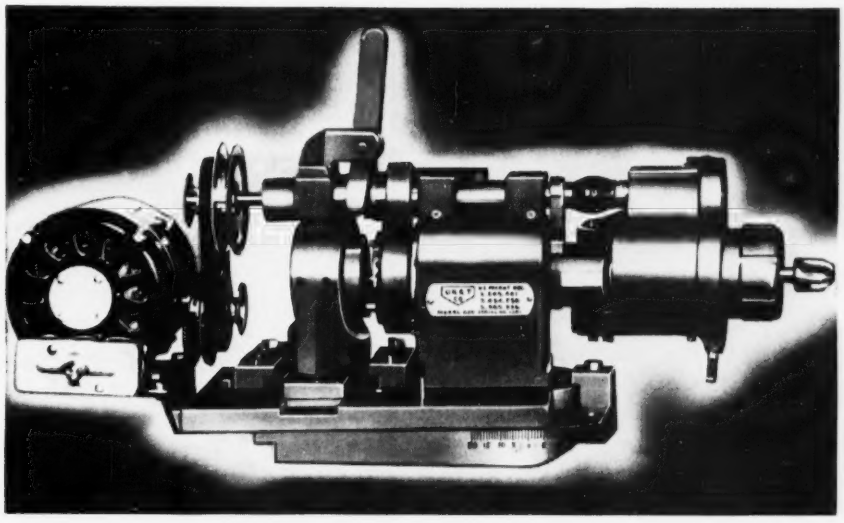
CYLINDERS, Air

Hannafin Corp., 1101 S. Kilbourn Ave., Chicago.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

(*Continued on page* 342)

For more information on products advertised, use Inquiry Card, page 247

Precision CIRCULARITY GRINDING ATTACHMENT



Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, radial relief, form and radial relief together, tapered cylindrical and straight cylindrical. Cutting tool to be produced or reworked is held in collet or between dead centers and revolves on its own axial center. Where full length of spiral cutting tools is to be ground for both form and radial relief, the Circularity Grinding Attachment travel is similar to an O.D. grinder, which insures fine finish, back taper and accurate size.

The Detroit Reamer & Tool Company Model 500 Circularity Grinding Attachment shown above is faster, easier to handle, has positive control, greater adaptability, rugged construction, and is engineered and precision built to provide the finest in precision work. Therefore, it will be of invaluable assistance to anyone whose tooling standards must meet modern production requirements.

You Can Grind Tools Like These on a **DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT**

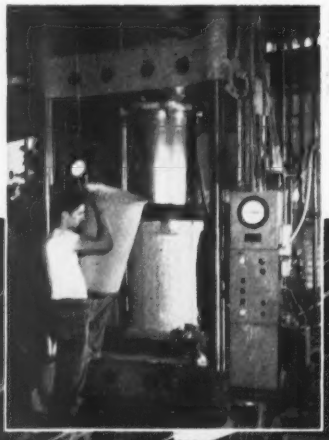
Special Cutting Tools of DEPENDABLE QUALITY

The Detroit Reamer & Tool Co. Plant is equipped with the finest in modern machinery and inspection facilities to provide you with the ultimate in precision tools. Our Engineering and production personnel with 35 years of empirical knowledge behind them are completely qualified to expertly handle your tool needs. For dependable cutting tools—specify Detroit Reamer & Tool Co.

DETROIT REAMER & TOOL CO.

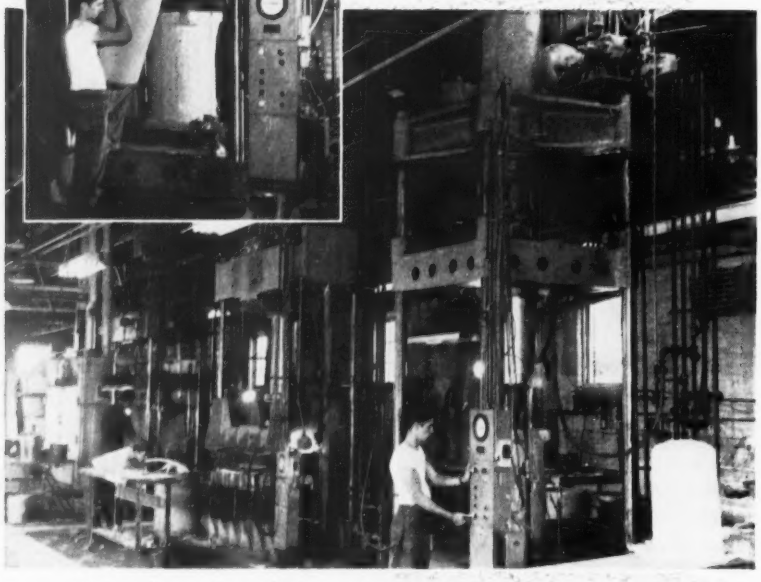
2830 E. SEVEN MILE ROAD • DETROIT 34, MICH.

D R & T COMPANY



Finished mold for electronic housing being removed from 100-ton press.

Over-all view of 80-ton, 40-ton and 100-ton Farquhar Hydraulic Presses at American Insulator Corporation, New Freedom, Pa.



American Insulator reports:

FARQUHAR HYDRAULIC PRESSES give "closer tolerances and greater strength"*

*A battery of Farquhar Hydraulic Presses currently in operation at American Insulator Corp., New Freedom, Pa., was selected originally because the presses had to be custom-made, and Farquhar was in the best position to do this. In addition to this advantage, the Farquhar Presses have now proved to be more economical in operation and capable of maintaining closer tolerances due to greater rigidity of platens. So reports Mr. W. F. Remphrey, foreman of American Insulator's reinforced plastics division.

Three presses (40-, 80- and 100-ton) are used for molding fibre glass for production of classified electronic housings. The same job that formerly required an hour to mold through a vacuum process now takes only *6 minutes* on a Farquhar Press! The hydraulic presses feature an automatic cycle, with one-man loading.

Farquhar Presses Cut Your Costs

The above installation is just one more example of Farquhar performance in heavy production! Farquhar Presses are built-for-the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of extra long guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

For a free catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industry, write to: THE OLIVER CORPORATION, A. B. Farquhar Division, *Hydraulic Press Dept.*, 1504 Duke St., York, Pa.

Farquhar
HYDRAULIC PRESSES
For Bending • Forming • Forcing • Straightening • Assembling • Drawing
Extruding • Jogging • Forging • and other Metalworking Operations

THE OLIVER CORPORATION • A. B. FARQUHAR DIVISION

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordance Co., Irvine, Warren County, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc. Murray Hill, N. J.

DIE-CASTING

See Castings, Die.

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

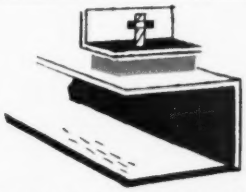
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 344)

For more information on products advertised, use Inquiry Card, page 247

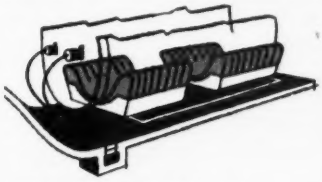
FELT for GASKETS (1)

There has to be a seal between the lid and body of electric power transformers, to exclude dirt and moisture, hold in the oil that insulates and cools. Felt is widely used for this purpose.



FELT absorbs VIBRATION (2)

To isolate spring-suspended gasoline tanks from the chassis of trucks and absorb road shocks and weaving strains, felt pads are used. These give enough to protect the tanks, but not enough to disturb gas lines.



FELT for LUBRICATION (3)

Many locomotive journals are lubricated by felt, cut to fit the hub. Pumped oil is fed evenly, waste-grabbing eliminated. Length of life of the felt is estimated at 75,000 to 100,000 miles of perfect lubrication.

FELT for POLISHING (4)

The final polishing operation on steel cutlery changes the finish from dull to bright. About .002" of steel is removed by felt polishing discs, fed with fine pumice. The discs are slotted for flexibility.

FELT in REFRIGERATION (5)

In refrigerators and air conditioners there is usually a cartridge filled with a dehydrating agent. Felt is used as a filter to prevent small particles of the drying crystals being carried into the refrigerant line.

GET THE FACTS ABOUT FELT

AND WHAT IT CAN DO FOR YOU

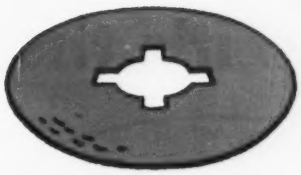
These are just a few of the many applications of felt in plants and products. Remember that felt is an engineering material, which can be specified as closely as any other. American makes felts as soft as a kitten's ear, or hard as a board, and many other types as well, including OilFoil seals, laminations of synthetic rubber and felt. We also cut felt parts in many shapes, designs and sizes to your blueprints. The Engineering and Research Laboratory will gladly collaborate with you on the selection of the correct felt for maximum economy and satisfaction. Mail the coupon below for further information.

American Felt Company

TRADE MARK

GENERAL OFFICES:
00 GLENVILLE ROAD, GLENVILLE, CONN.

SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Dallas, San Francisco, Los Angeles, Portland, Seattle, San Diego, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.—ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

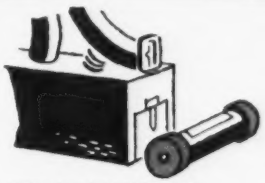


FELT CLUTCH FACING (6)

Industrial sewing machines have a clutch, which must take hold quickly, yet smoothly and firmly. These clutches operate properly when faced with felt discs cut to size and shape. This is a frictional application of felt.

FELT for HONING (7)

The cylinders of internal combustion engines are finished by honing. The honing head carries abrasive stones alternated with strips of felt, the latter greatly improving the quality of the surface obtained.



FELT for SHOCKS (8)

Pneumatic carriers of both large and small sizes are in wide use. American supplies special felts for them. One type is used as a bumper head on the carrier to absorb shock on delivery; another is an air-pressure seal.

FELT for FIRE EXTINGUISHERS (9)

Hand-pumped fire extinguishers use felt washers for lubrication, for holding compression, as a bumper for the upstroke, and as a cushion for the nozzle. American also supplies flame-proofed felt for airplanes, theatres, etc.

AMERICAN FELT COMPANY
68 Glenville Road, Glenville, Conn.

1 2 3 4 5 6 7 8 9

Please send me further information about the application circled above.

NAME.....

TITLE.....

FIRM.....

STREET.....

CITY.....ZONE.....STATE.....

OVER ONE HUNDRED YEARS OF CONTINUOUS SERVICE. ROUNDS, SQUARES, FLATS, HEXAGONS, OCTAGONS

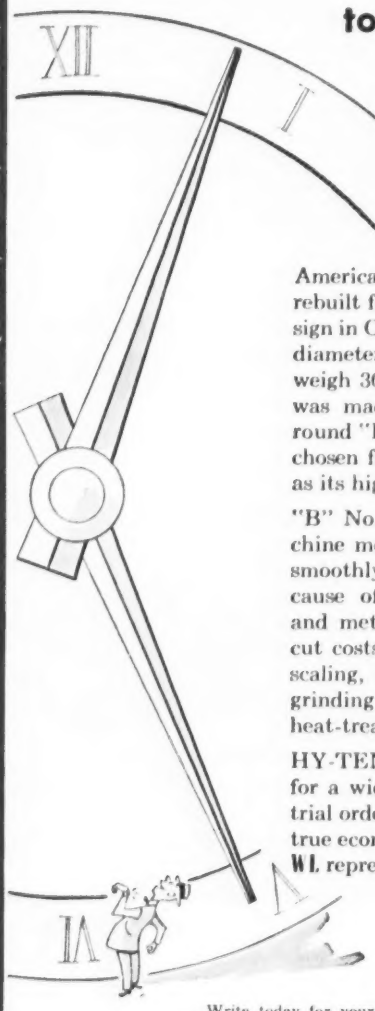
BILLETS AND FORGINGS FOR PRODUCTION, TOOL ROOM AND MAINTENANCE REQUIREMENTS

it's the right time

to Investigate the Qualities of

HY-TEN

ALLOY STEEL



America's largest clock was recently rebuilt for a spectacular illuminated sign in Chicago. It measures 50 ft. in diameter — hands and movement weigh 3000 lbs. The new driveshaft was made from 6 ft. of 3½-inch round "B" No. 3X heat-treated bar, chosen for its machinability as well as its high physical properties.

"B" No. 3X heat-treated bars machine more readily and finish more smoothly than standard alloys because of their particular analysis and method of manufacture. They cut costs by eliminating distortion, scaling, straightening — and often grinding — as well as the cost of heat-treating finished parts.

HY-TEN "B" No. 3X bars are used for a wide range of applications. A trial order will convince you of their true economy. Just call your nearest W-L representative.

Write today for your FREE COPIES of Wheelock, Lovejoy Data Sheets, indicating your title and company identification. It contains complete technical information on grades, applications, physical properties, tests, heat treating, etc.

WHEELOCK, LOVEJOY & COMPANY, INC.

HY-TEN and AISI

Warehouse Service

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SANDERSON-NEWBOULD, LTD., MONTREAL

138 Sidney St., Cambridge 39, Mass. and Cleveland • Chicago • Detroit Hillside, N. J. • Buffalo • Cincinnati

DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob Bros., Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die.

DIES, Sheet Metal, Etc.

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
John B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara M ch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.

(Continued on page 346)

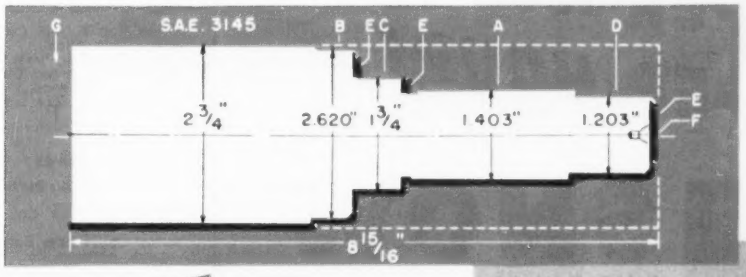
This is the difference High Velocity Turning makes

this job took...

12.40 min.

FLOOR TO FLOOR

A. Turn 489 RPM — .011 feed
B. Turn 340 RPM — .022 feed
C. Turn 489 RPM — .011 feed
D. Turn 489 RPM — .011 feed
E. Face end, shoulders & neck 489 RPM — .0055 feed
Chamfer
F. Center drill
G. Cut off 82 RPM — .0035 feed H.S.S.



IN 1954 this same job takes...

5.40 min.

FLOOR TO FLOOR

A. Turn 694 RPM — .022 feed
B. Turn 694 RPM — .022 feed
C. Turn 694 RPM — .022 feed
D. Turn 694 RPM — .022 feed
E. Face end, shoulders and neck — 694 RPM — .055 feed
Chamfer
F. Center drill
G. Cut off 489 RPM — .0025 feed

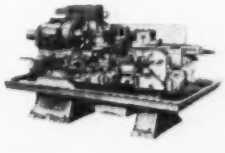
J & L TURRET LATHES GIVE...

MORE Ease of Operation
MORE Power Transmission
MORE Rigidity
MORE Accurate Stops
MORE Efficient Lubrication
MORE Coolant on Cutting Tools
MORE Accurate Results

Visitors who attend J&L's periodic "Production Studies" Seminars see this job turned out in just 5.40 min. on a Jones & Lamson #7A Universal Turret Lathe.

Only with lathes like this, built with plenty of power and the beef to back it up, can your shop take full advantage of the quality, productivity and lower costs offered by High Velocity Turning.

P.S. *This job is one of the many turned at high speeds on our production line. Come to Springfield and see for yourself. At any rate, send for catalogs #101-A and #102.*



JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L MACHINE TOOL DIV.

For more information on products advertised, use Inquiry Card, page 247

Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

For Top Production

SNOW

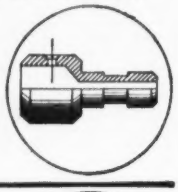
FULL UNIVERSAL MACHINES

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

Crossdrill and C'T" Sink 1/16" Hole

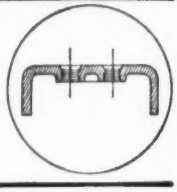
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine



TAPPING

Tap Two #10-32 Holes

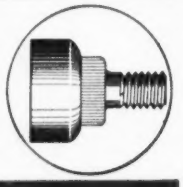
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine



THREADING

3/8"—24 Thread—1/2" Long

Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine



Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

Submit Sample Parts fo

SNOW

MANUFACTURING COMPANY
435 Eastern Ave., Bellwood, Illinois
(Chicago Suburb)

Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland,, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Metalmaster Div., Clinton Machine Co., Clinton, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment.

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill. Detroit 2, Mich.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

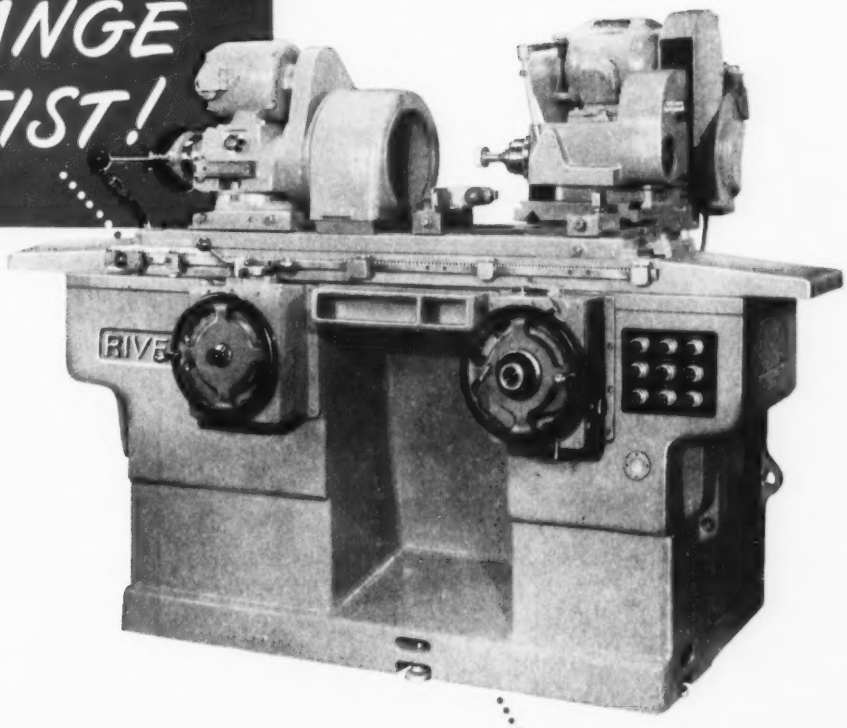
DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

(*Continued on page* 348)

For more information on products advertised, use Inquiry Card, page 247

QUICK-CHANGE ARTIST!



RIVETT

INTERNAL AND UNIVERSAL GRINDER

- Grind holes 1/8" to 9" dia. and plug gauge to 6" depth—or to approximately 14" by retracting wheelhead slide.
- External grinding to 12" dia. by 21" length.
- Internal spindles 6,000 to 35,000 R.P.M.
- External spindle has double row roller bearings for radial load and ball bearings for end thrust.
- Double swivels on cross slide for two angle internal and external grinding.
- Sine bar measures swivel of workhead or table for perfect taper grinding.
- Workhead spindle mounts draw-in collets and step chucks directly.

has double-end wheelhead—*

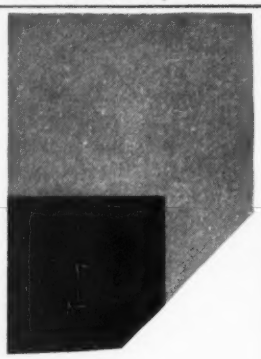
Eliminates costly delay in converting to external work

* Machine can be furnished with single-end wheelhead for internal grinding only.

RIVETT **LATHE & GRINDER, Inc.**

Dept. MR-3, Brighton 35, Boston, Massachusetts

For More Precision Work *RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools*

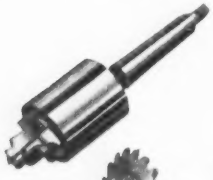


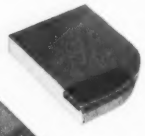
for Special Service on Carbide "Specials"

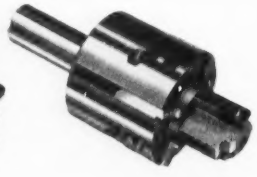
GORHAM

GORHAM

GORHAM







When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

(*Continued on page* 350)

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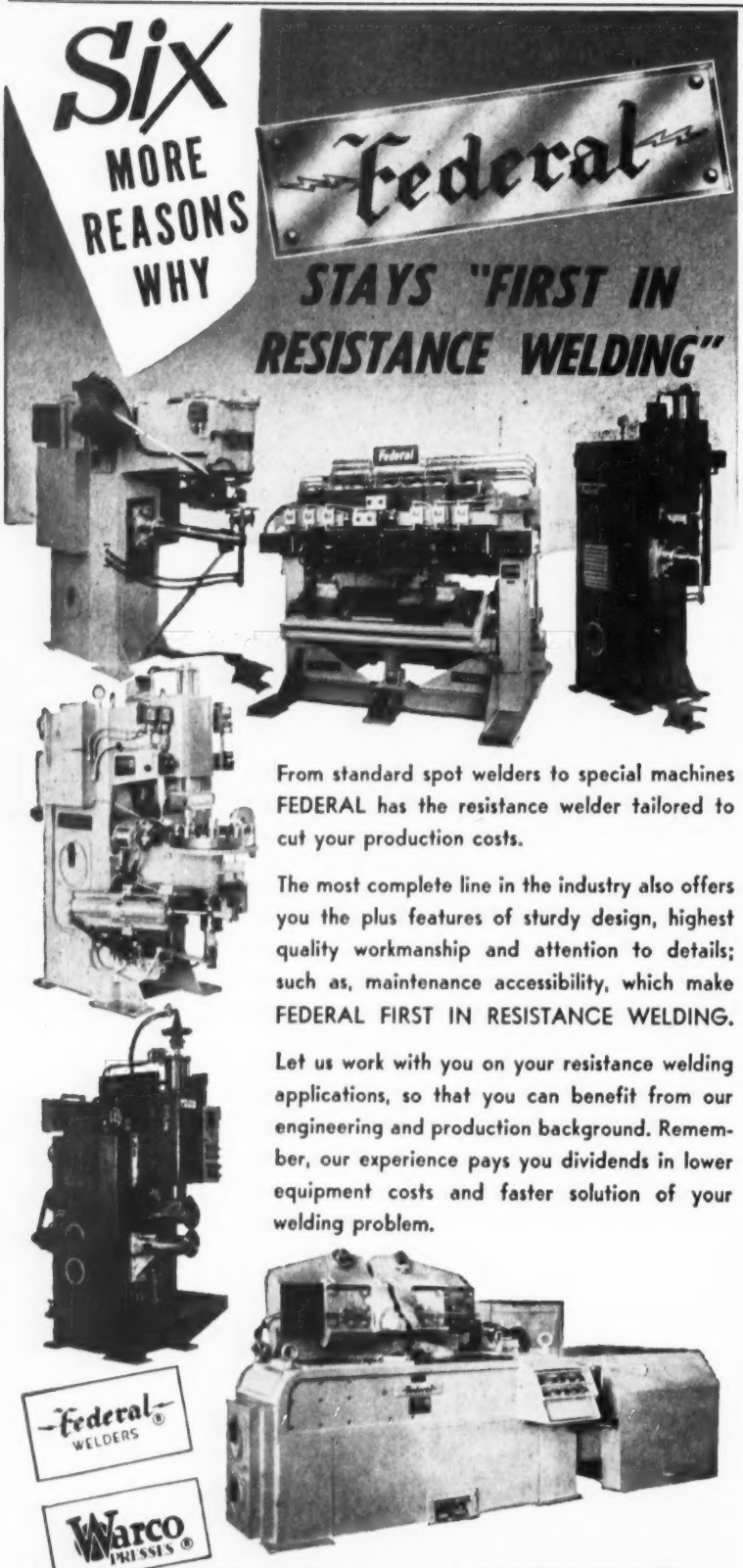
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From standard spot welders to special machines FEDERAL has the resistance welder tailored to cut your production costs.
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Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc. 425 E. Madison St., South Bend, Ind.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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(Continued on page 352)

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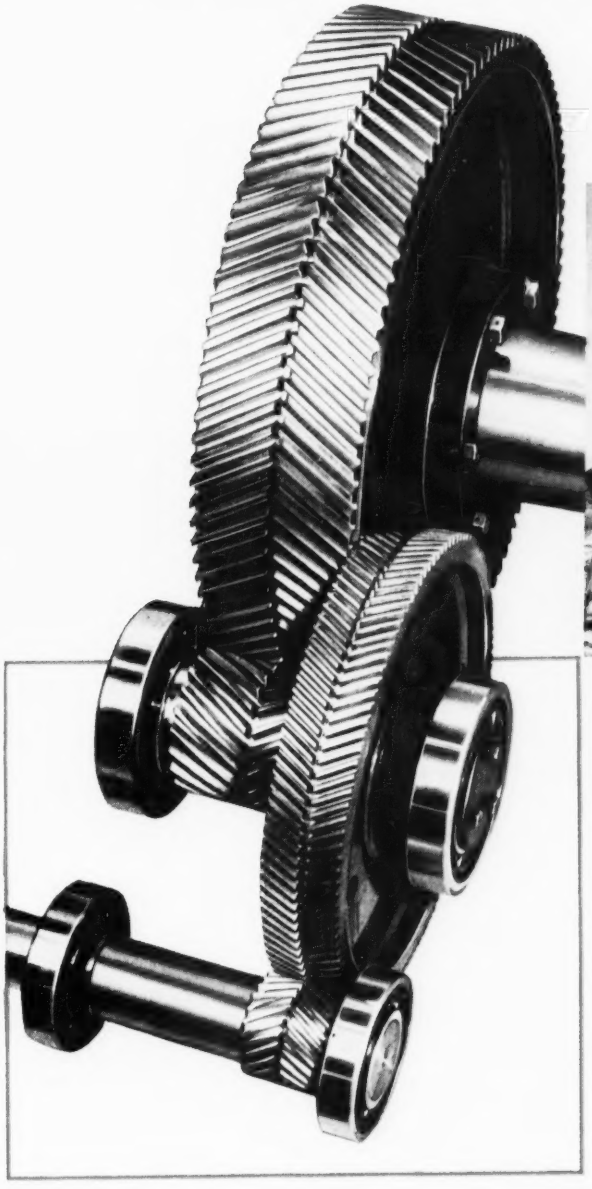
FLOATING ON HYATTS!



This is a job for straight roller bearings, and EMSCO relies on HYATTS!

Take a good look at these herringbone gears—and at the four bearings supporting the two smaller shafts. These particular herringbones operate in the gear box of EMSCO's newest pumping unit, and the bearings are *Hyatt Hy-Loads!* For oilmen, this is a combination that means longer bearing life and lower maintenance costs, because only *straight radial bearings* permit these gears to locate themselves for most efficient operation. And when the application calls for radial-type bearings, EMSCO engineers specify Hyatts. Hyatts offer the proven advantages of easy assembly, simple maintenance, complete interchangeability of parts, and longer life. Insist on Hyatt Hy-Load Bearings for herringbone gear applications.

HYATT ROLLER BEARINGS

STRAIGHT ◯ BARREL ◯ TAPER ◯

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What's in this NAME?

KENDEX*

It's the Trade-Name for Multiple-edge, Indexable, Tungsten Carbide Insert Tools Produced by Kennametal Inc.

EXCLUSIVE FEATURES

1. *Made of Kennametal*—Kendex inserts have its uniform high hardness and exceptionally long life.
2. *Multiple, precision-ground cutting edges*—enabling a clean, sharp edge to be kept against the work continuously.
3. *Screw-mounted*—can be accurately indexed to a new cutting position, in seconds, without removing tool shank from holder.

OPERATING ADVANTAGES

1. *Minimize downtime for tool changing*—major cause of high-cost operation.
2. *Eliminate tool grinding*—no regrinding; Kendex inserts are thrown away when all cutting edges have been used.
3. "Balanced" tool budget—it's penny-wise and pound foolish to "save" money by excessive reconditioning of old tools, when you can keep new cutting edges on the job continuously with Kendex inserts.

Ask your nearest Kennametal representative for details. Kennametal Inc., Latrobe, Pa.

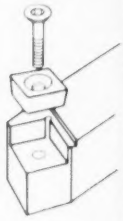
How KENDEX* Works

1

Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.

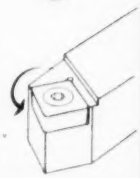
2

Kendex inserts are mounted to suitable tool holders with socket head screws.



3

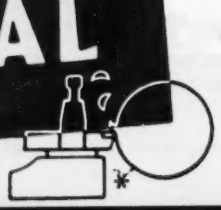
When edge becomes dull, insert is turned to new cutting position. When all cutting edges have been used, insert is thrown away; no regrinding.



*Registered Trade-Marks

KENNAMETAL

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY



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A-3

DRILLING MACHINES, Horiz. Duplex

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St. Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.

(Continued on page 356)

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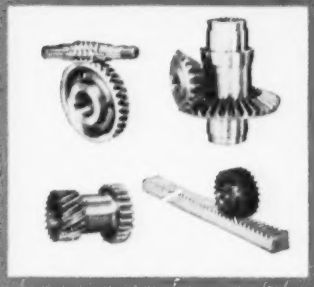

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INSPECTION COSTS DROP! These three Federal Electricator Gages inspect two diameters, a shoulder distance and overall length of tiny watch parts . . . simultaneously. Signal lights tell when dimensions are off-size. DIAL INDICATORS SHOW HOW MUCH.

ACCURATE ASSEMBLY! Here's how a Federal Dial Indicator is used in balancing and adjusting gears at assembly of an automatic pilot.

FULL LENGTH INSPECTION! This Federal Continuous Measuring Gage checks full length diameter of hard rubber tubes as they emerge from centerless grinder. Signal lights show operator when tube diameters are within, over or under tolerances. This gage can be modified for COMPLETELY AUTOMATIC SORTING.

MEASURABLY REDUCED!

COST-CUTTING PROGRAMS PAY OFF only when process, production and quality control engineers use up-to-date methods and equipment. How much are out-moded gages handicapping *your* progress?

COSTS CAN BE CUT SEVEN WAYS when modern Federal Gages take over:

1. Reduction in undersize dimensions and oversize holes which scrap up to 10% of production.

2. Less rework on oversize work which hogs as much as 30% machine time in some plants.

3. Material costs cut through purchase of smaller-sized stock, made possible by holding work to closer tolerances.

4. Inspection time halved when visual indicating gages replace ordinary micrometers, vernier calipers and fixed gages. Even higher savings result when Federal multi-dimensional and sorting gages are used.

5. Quality control simplified by gages that warn machine operators *before* they produce scrap.

6. Assembly speeded when visual indicating or automatic sorting catches out-of-tolerance parts formerly overlooked because of human error.

7. Gaging costs cut when Federal MODIFIED STOCK GAGES eliminate need for costly special gage engineering.

INVESTIGATE! Catalog 52 shows Federal Gages which help cut costs all along the line. Write for your copy today. Federal Products Corporation, 4113 Eddy St., Providence 1, R. I.

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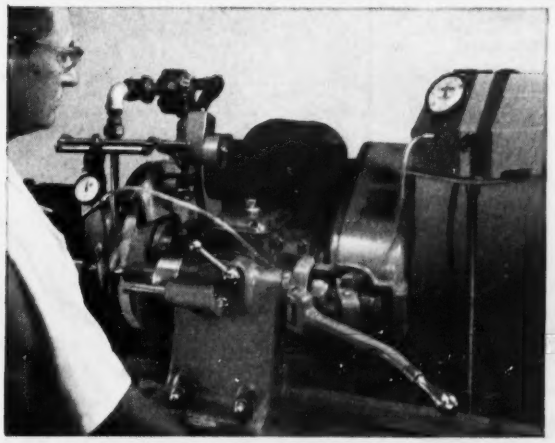
Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES... **Visit Booths 315 – 321**

DIAL INDICATING, AIR, ELECTRIC OR ELECTRONIC – FOR INSPECTING, MEASURING, SORTING OR MACHINE SIZE CONTROL.

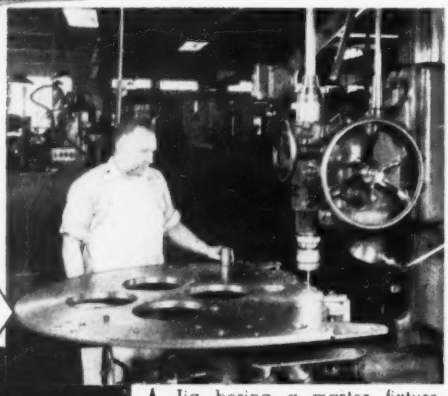


ACCURACY and OUTPUT INCREASED! Here, the new FEDERAL ARNOLDAIR unit is applied to the well known Arnold continuous grinding gage. This makes faster and more positive dial reading. Work is ground to required dimensions more positively, with less human attention.

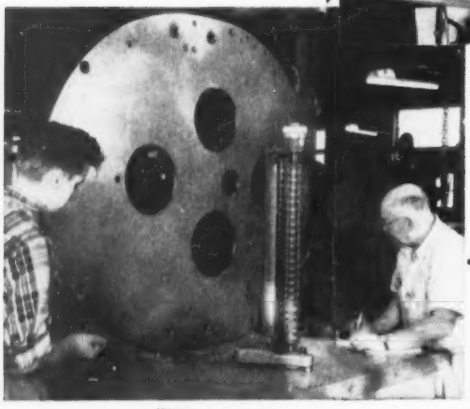
MULTIPLE MEASUREMENTS AT A GLANCE! This operator is measuring the concentricity of the pitch diameters of two sets of teeth by means of the center Indicators. With the same gage she then checks the concentricity of the hole at each end of the gear in relation to the body O.D.

Contract Jig Boring

What B. Jahn Can Do For You!



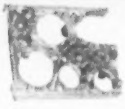
Single jig boring projects such as this jet aircraft fixture.

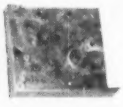


Jig boring a master fixture section for jet aircraft. Bushings were fitted to multiple holes with tolerances accurate to .0005".

Final inspection of one of four fixture sections for jet aircraft. This master fixture measures 18 feet when fully assembled.

Production jig boring projects such as thousands of these precision components.





Or this seemingly impossible assignment: To bore over 148 different size holes at different angles, holding rigid relative tolerances into precision alloy castings, completed value of which, was over $5000 each.

Engineers are relying on B. Jahn every day to lick their *real tough* problems. Investigate the facilities at B. Jahn. 16 of the latest jig borers, every size, manned by master toolmakers and piloted by the best engineering brains available.

Investigate B. Jahn and Invest in Production Economy!

SEND FOR FACILITY LIST AND LITERATURE — REQUESTS FOR QUOTATIONS WILL BE HANDLED PROMPTLY

B. Jahn

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Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.

(*Continued on page* 358)

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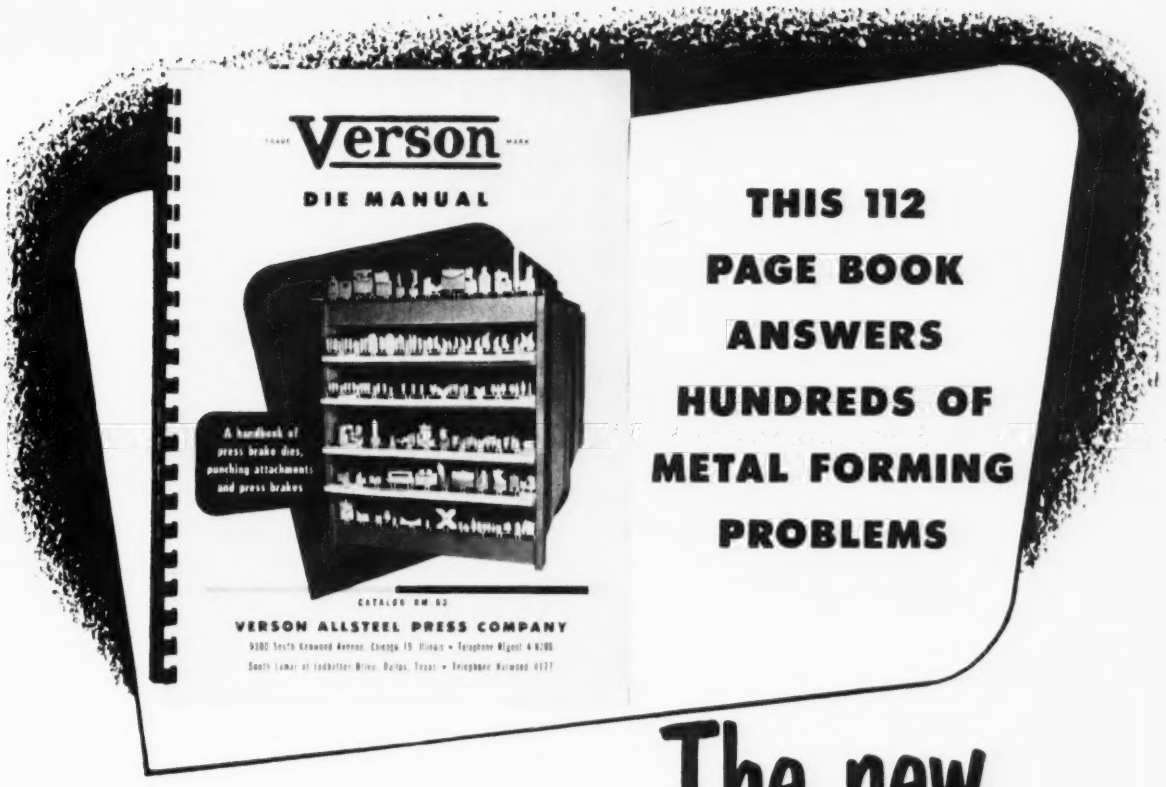
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DIE MANUAL
A handbook of press brake dies, punching attachments and press brakes
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VERSON ALLSTEEL PRESS COMPANY

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The new Verson DIE MANUAL

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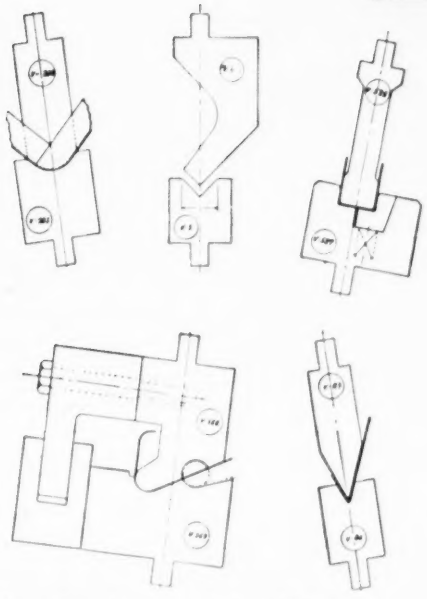

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JUST off the press, the new enlarged Silver Anniversary edition of the Verson Die Manual contains 112 pages devoted to a pictorial presentation of Verson press brake dies and special tooling along with detailed text and tables on how to select dies for specific jobs, tonnages required, etc. Representing the culmination of twenty-five years of Verson Die Manuals, this edition has been developed and organized to be as convenient and helpful to the user as we know how to make it, even to the point of incorporating a plastic binding that permits the book to lay flat wherever it is opened. While the Manual does not show every possible press brake die, it is remarkably complete and covers all commonly used types. To get your copy simply write on your company letterhead.

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Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St. Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Orban Kurt Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rohnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page 360*)

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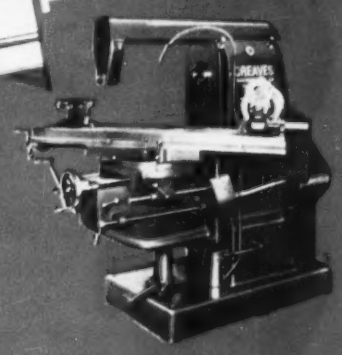
get good milling machine performance with **GREAVES**

PLAIN · UNIVERSAL MILLING MACHINES

Keywaying cluster gear on Greaves 2H plain milling machine using Greaves slotting attachment.



It's true! Greaves 2H plain and universal milling machines are priced way below the top 8 competitive mills . . . yet give top performance. They're powerful! Full range of speeds and feeds. Large capacity. *And they're accurate!*

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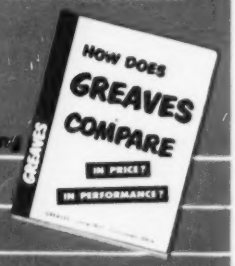

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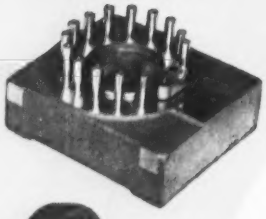

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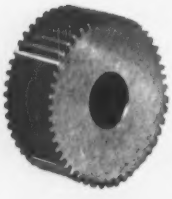

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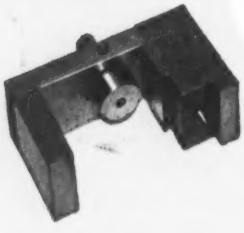

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap — Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Besley-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rickford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois, Detroit, Mich.

(*Continued on page 362*)

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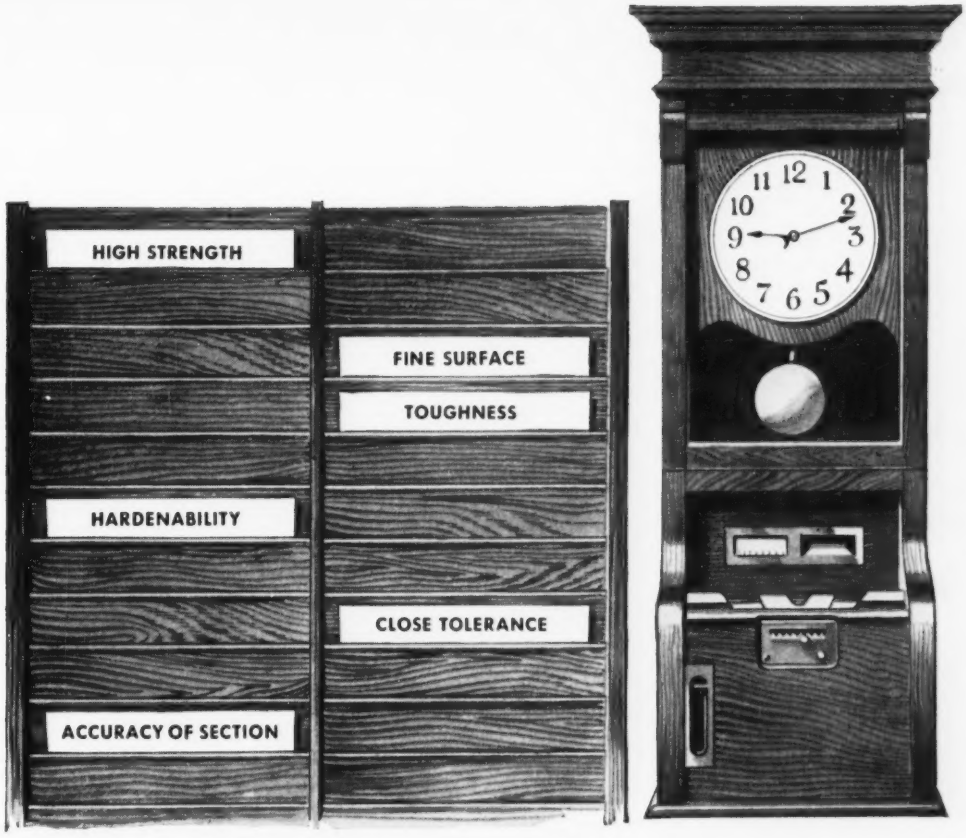

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SEE THE DIFFERENCE

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4. Self-contained operating screws
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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

EMERY WHEELS
See Grinding Wheels.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts. Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic
Federal Press Co., 600 Division and Big Four R. R. Elkhart, Ind.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
Atrax Co., Newington, Conn.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis, Chas. L., Co., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Thor Power Tool Co., Aurora, Ill.

FILING MACHINES, Dies, Etc.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob Bros., Grafton, Wis.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

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Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis 7, Ind.

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See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT
Jarvis, Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGINGS, Hollow Bored
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

(*Continued on page 364*)

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

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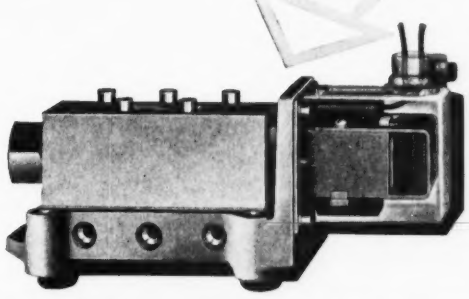

1/8" and 1/4" Single Solenoid Valves

They'll give you up to 300 cycles a minute
For air to 125 psi—vacuum—
or low pressure hydraulic service

● These valves combine the utmost simplicity in design with rugged construction. They will give you millions of cycles of highly satisfactory, efficient, trouble-free service. Small solenoid, with short stroke operates the valve plunger, eliminating levers, links and pins. Low amperage requirement eliminates intermediate relays and simplifies electrical control circuits. Side or bottom pipe connections. Valve body and solenoid are both mounted on an aluminum base and can be removed independently without disturbing the piping. 2, 3, 4 and 5-way actions. *Write for full details today!*

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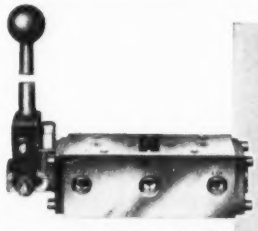
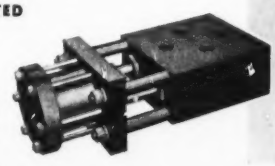


LEVER OPERATED SINGLE PLUNGER VALVES

Two position and three position valves, 3/8" to 1 1/2" sizes; 2-way, 3-way and 4-way actions. Widely used for controlling the operation of single and double acting cylinders or as pilots for operating other valves.

PILOT CYLINDER OPERATED HYDRAULIC VALVES



Two position valves, 1/2" to 4" sizes, for line pressures from 1000 to 5000 psi. Valve is placed close to the work and operated from a central control point with an easy to handle air valve avoiding operator fatigue.

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Hand, Foot, Lever, Cam, Pilot, Diaphragm and Solenoid Control Valves

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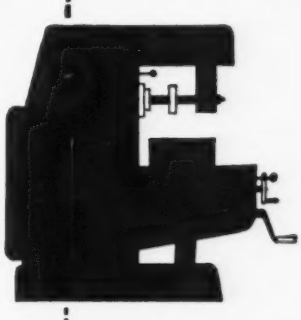

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Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 247

FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.

FRAMES, Machinery Welded

Mahon, R. H. Co., Detroit 34, Mich.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator

Alina Corp., 401 Broadway, New York 13, N. Y.
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St. New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.

(Continued on page 366)

The Ultimate in Coil Cradles!

Medelton Motor Driven Coil Cradles are designed to give the utmost in ease of handling your coil stock. The coils are rolled directly into the cradle. There is no lifting. A slack loop is always available thus eliminating all drag on feed or dies. This lessens operator fatigue and results in 30 to 40% greater production. They butt up directly against the press saving valuable floor space.

"POWEROLL" MODEL

★ LOW PRICE

"GRIP FEED" MODEL

Has exclusive "swing away" arm allowing entrance of coil. Uncoiling accomplished by means of hardened pinch rollers which pull out the stock to the last inch with **absolutely no slippage or binding even on stock up to 1/8" thick.** Designed to hold up to 12" wide, 2400 lb. coils.

R-103—10" width, 800# cap.
R-203—12" width, 2000# cap.

NOW

Furnished with hardened sand blasted rollers.
Positive stop to prevent switch damage.
Increased size of side plates to provide larger guiding surface.
Also available in 14", 16", 18", 24" widths.

Write for Brochure, Specifications and Surprising Low Prices.

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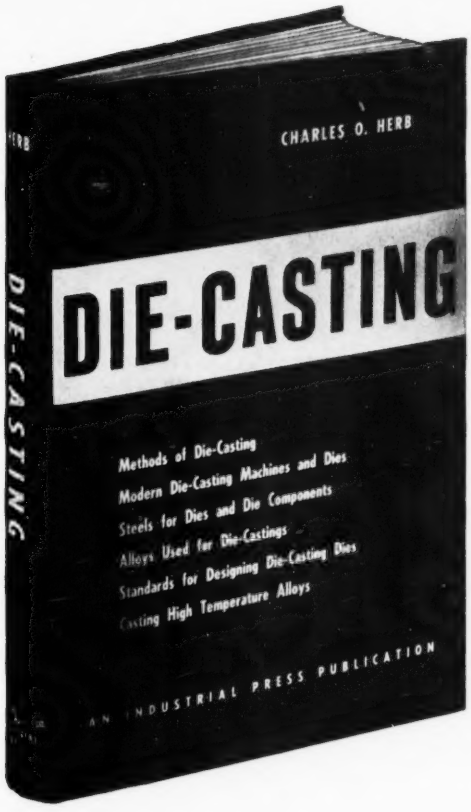
Machine Tools

100 STEVENS AVE. MOUNT VERNON, N.Y.
245 CONNECTICUT AVE. BRIDGEPORT, CONN.

For more information on products advertised, use Inquiry Card, page 247



A Standard Reference Treatise on Die-Casting Machines, Dies and Alloys

DIE-CASTING, by Charles O. Herb, Editor of MACHINERY, covers die-casting from its earliest phases up to today's advanced practices. It is a valuable reference work for everyone engaged in the design, production or use of die-castings.

The latest models of automatic and manually operated die-casting machines are illustrated and described, including fully hydraulic machines of the vertical and horizontal cold-chamber types, air-operated vertical machines, machines convertible from cold-chamber to goose-neck type operation, etc.

Tables of die-casting alloy compositions include the latest developments, and are supplemented by text discussion of their properties and applications.

A distinctive feature is the large number of illustrations and detailed descriptions of dies for parts ranging from simple shapes to complex forms. The die designs illustrated are the work of outstanding die-design specialists, and have been successfully used in industry. To further aid the designer, there is a section illustrating and describing the die-design standards used by a leading manufacturer of die-castings and die-casting equipment. The dies have been classified in groups according to their most distinguishing characteristic to facilitate locating a general design or type of die adapted to a given class of work.

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M-3/54

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Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpes Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

(Continued on page 368)

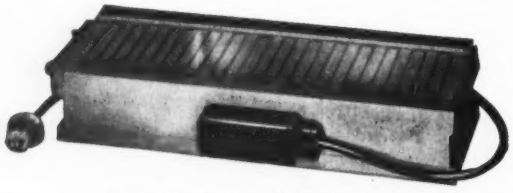
Walker Chucks

People dismiss as incredible the things they do not understand.

Incredible indeed was the discovery of the force of magnetism when, according to legend, a Phrygian shepherd picked up bits of dark colored stone on the iron end of his crook.

Incredible also seemed the experience of man when he discovered the polarity of magnets. And—when Oakley S. Walker, founder of O. S. Walker Company, Inc., displayed the first magnetic chuck to his friends, they were incredible. But—not Mr. Walker, because he had experienced the fulfillment of logical thinking processes.

Today, Walker Magnetic Chucks are performing important functions in industry everywhere; and Walker engineers, as they have in the past, stand ready to solve any holding problem.



No. 618 Rectangular Magnetic Chuck

Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

For more information on products advertised, use Inquiry Card, page 247

ACCO products

CAMPBELL Nibbling Machines

How this CAMPBELL Nibbler steps up production

• Operator feeds sheets or plates into this CAMPBELL Nibbling Machine with both hands. No adjustment of any part of the machine is necessary to change the direction of the cut. A template, clamped above the work, guides the punch accurately to any shape or design. Machine is equipped with V-belt drive completely enclosed.

MODEL 2524 cuts low carbon steel and other soft materials up to ¼" thickness—corrosion resisting steel up to 3/16" thickness. The variable stroke is easily changed with a wrench. The nibbled part is comparatively smooth and requires only a little finishing for an absolutely smooth edge.

The machine is of exceptionally heavy construction, one piece, with C-shaped steel frame, heavily ribbed to insure maximum rigidity. It is strong enough to cut ¼" soft metal without springing the head or injuring the punch and die. It will do all nibbling operations within its capacity without distorting the metal, without setting up strains or starting invisible fractures.

CAMPBELL *makes a complete line of Nibblers and Abrasive Cutters. One of them could save money for you. Write for literature. Tell us your job and let us assist in the selection of the* CAMPBELL *nibbler or abrasive cutter best suited to it. Write for catalog.*

ACCO TRADE MARK

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AMERICAN CHAIN & CABLE
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Wet and Dry Cutters and Nibblers

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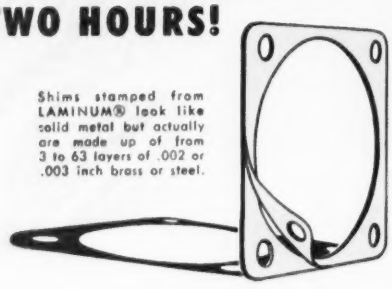
CAN SAVE YOU TWO HOURS!



Shims stamped from LAMINUM® look like solid metal but actually are made up of from 3 to 63 layers of .002 or .003 inch brass or steel.

Adjusting bevel gear mesh with a laminated shim is a matter of two seconds to remove a lamination!

The shim in this case is made of LAMINUM®, our exclusive material. It is a "solid" unit built up of 16 layers of .002 brass. It peels quickly and easily. Each shim removed adjusts the bevel gear position by two thousandths.

You save time by easier machining tolerances on the housing; ***you save time*** by eliminating pesky assembly machining; ***you save*** by not tying up a machine intermittently. IT'S EASIER!

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Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17
Gear Grinding Machine Co., Detroit, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, CUT

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Automotive Gear Works, Inc., Richmond, Ind.

(*Continued on page* 370)

For more information on products advertised, use Inquiry Card, page 247

116 parts an hour with 7-unit trunnion machine

Efficiency, economy and speed in producing torque converter housing adapter plates is the key word of a large automotive manufacturer.

Specifically designed to do this job is the Baush 2-Way Horizontal Mechanical Machine illustrated which meets J. I. C. Standards.

Each of the 7 mechanical leadscrew units has a 24" stroke with a total of 47 spindles. Trunnion fixture has 5 holding units and guide bushings for tools. Fixture operates hydraulically to drill, rough and finish bore, finish ream, countersink, chamfer and tap 116 Plate Torque Converter Housing Adapters per hour at 100% efficiency.

KNOW YOUR COSTS — TAKE GUESSWORK OUT OF MACHINE REPLACEMENT. Check every 10 year old machine for direct labor, down time, maintenance, production! Competition demands the best ideas in automatic equipment for high speed and low costs.

WHY NOT CONSIDER
BAUSH AUTOMATIC EQUIPMENT FOR YOUR JOB?

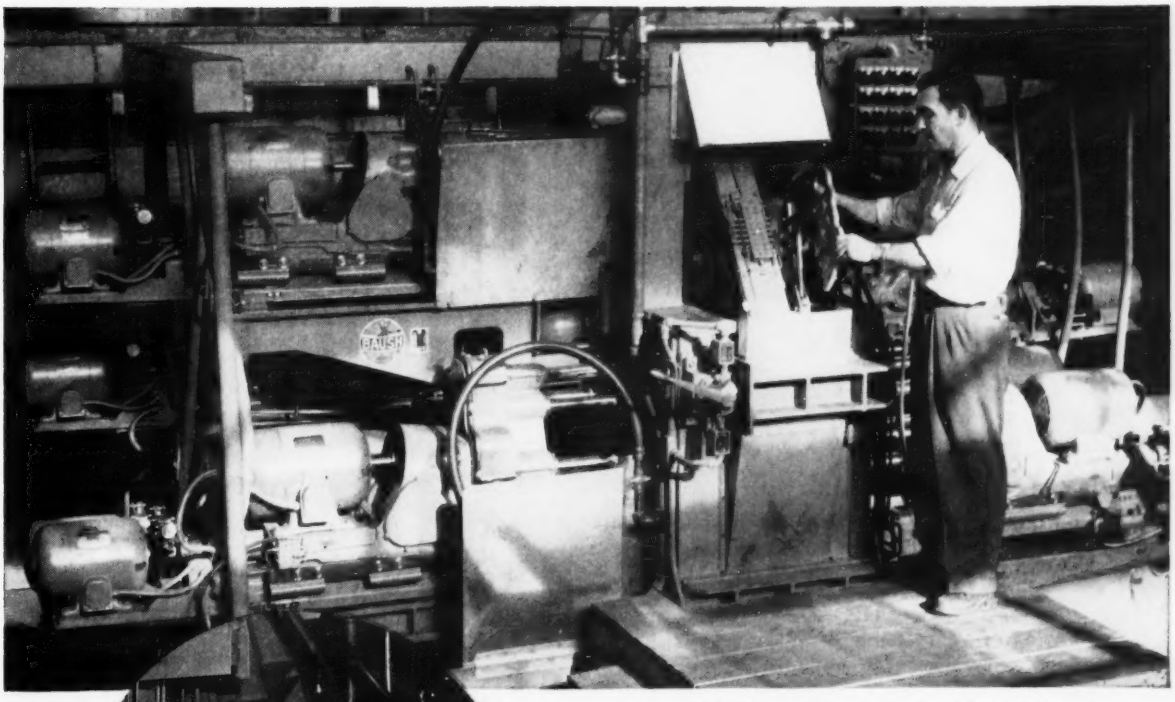
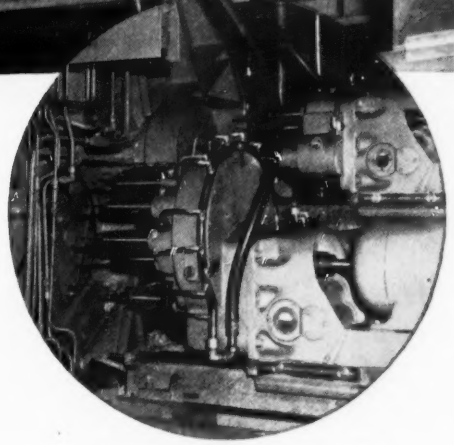


Plate Torque Converter Housing Adapter being set into holding unit on Baush 7-Unit Trunnion Machine.



Showing one of the 7 mechanical leadscrew units ready for drilling operation.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Franke Gear Works, Inc., 1924 W. Columbia Ave., Chicago 26, Ill.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia Pa.
Pittsburgh Gear Co., 2700 Smallman St., Pittsburgh, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

Amgears, Inc., 6633 W. 65th St., Chicago 38.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Pittsburgh Gear Co., 2700 Smallman St., Pittsburgh, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

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GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Centerless

Van Norman Co., Springfield, Mass.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N.Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

(*Continued on page* 372)

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Applied Experience To Save You Money

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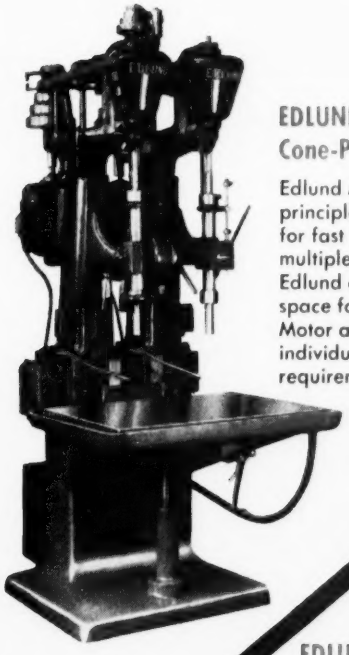
Modern design — customer shop proved for increased production . . . longer tool life . . . greater accuracy . . . faster work handling.



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Edlund Model B machines incorporate the best principles of design and rugged construction for fast production at low cost. Single and multiple spindle machines. Practical Edlund attachments. Ample table space for efficient work handling. Motor and spindle speeds for your individual operating requirements.

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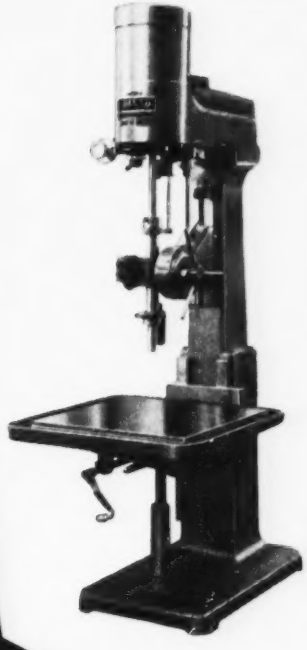
A motor spindle high speed drilling machine with the rigidity essential to accuracy and long life. Built for general production and tool room service. All running parts ball bearing mounted and of rugged Edlund construction. Made in single and multiple spindle machines. Motors coupled directly to spindles meet demand for no-belt drive machines.

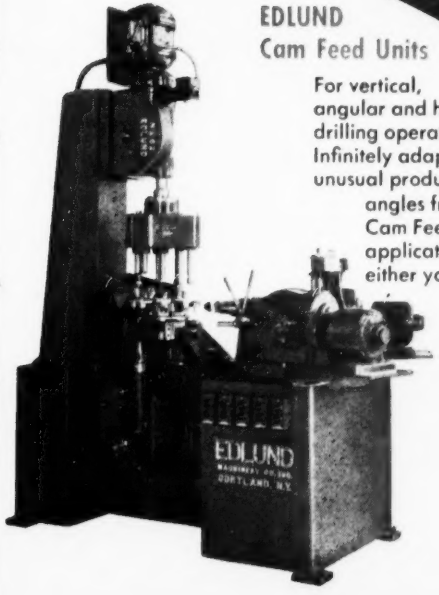
EDLUND Variable Speed Model 2F

The greatest advance in drilling machines in the past 25 years. Infinitely variable speeds result in production increases of twenty-five percent and more. Speed changes selected instantly without stopping. Longer tool life and increased production. One to eight spindle machines available.



EDLUND Cam Feed Units

For vertical, angular and horizontal drilling operations. Infinitely adaptable to meet unusual production problems and drill at angles from main machine operations. Cam Feed Units step up production, cut costs and applications are limited only by the ingenuity of either your or our engineers.



For detailed specifications on the EDLUND Line of Drilling and Tapping machines write for Edlund Bulletin G 53

Dealer Representation in Major Cities

EDLUND MACHINERY COMPANY
Cortland, New York

Affiliated with Precision Castings Co., Inc. Division Bradley Edlund Corp.

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Thor Power Tool Co., Aurora, Ill.

GRINDING FIXTURES

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besly-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gear Grinding Machine Co., Detroit, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

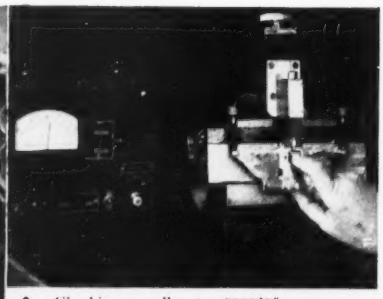
GRINDER MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.

(Continued on page 374)



▲ Checking a roller to .000020" on taper, diameter and out-of-round in reciprocating fixture with Par-Ac gage head.

◀ Centering a race within .000020" before grinding. Indi-Ac electronic indicator shows runout as work rotates.

INDI-AC and PAR-AC GAGES Help the TIMKEN Company Make Bearings to .000075" Maximum Runout

TIMKEN "Double Zero" tapered roller bearings are produced with a maximum runout of only .000075" (*75 millionths*). This means that the factors producing runout must be held to .000025" or less in races and rollers.

Working to such accuracy on a production basis calls for unusual methods—and for highly-sensitive gaging equipment that is rugged . . . dependable . . . fast-acting . . . and easy to set up and read. To meet these requirements, Timken Company engineers chose Indi-Ac and Par-Ac electronic gaging equipment.

Indi-Ac Electronic Indicators are used

- in centering races to .000020" runout of the OD, for setting up to grind the ID concentric.
- in spot-checking and 100% final inspection of finished races, to see that the faces are parallel, the taper square with the faces, and the ID and OD concentric—all within .000025".
- in final inspection of all assembled bearings, for flatness or parallelism and for runout—both within .000075".

Par-Ac Production Gage heads and amplifiers are used

- at the machines in production inspection of rollers after grinding, for diameter, taper, and out-of-round within .000020".
- in 100% final inspection of rollers as above—and for sorting the rollers by diameter in increments of .000020".

Whether or not *your* tolerances are as close as these, Cleveland Electronic Gages can serve you well in the shop, toolroom or gage room. Write for bulletins on the Indi-Ac and Par-Ac—and on the Micro-Ac (reads .000001" per division).

P.S. Timken's production methods on "Double Zero" bearings are described more fully in an article reprint. Want a copy?

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For more information on products advertised, use Inquiry Card, page 247

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DUAL TRACER LATHES
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GRINDING MACHINES, Drill

Blake, Edward Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., Beloit, Wis.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
land, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Mattison Machine Works, Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co. 1050 Findlay St., Cincinnati 14, Ohio

(Continued on page 376)

High Speed "Controlled Tapping"

New TRU-GRIP Tap Holder

Saves Taps . . . Stops Spoilage . . .

"Controlled Tapping" is the nearest to automatic tapping perfection yet developed! AND users of Procunier tapping heads have been enjoying this advantage for many years. "Controlled Tapping" action is made possible by a unique, exclusive clutch design. It's the heart of the tapper—and operates with a smooth, sensitive "cushioned action." The tap driving power is automatically regulated by the pressure applied thru the drill press spindle. Large or dull taps require more pressure and driving power than smaller, sharper ones—and "green" as well as experienced operators can quickly detect dull or loaded taps by the "feel" or pressure applied. The acute sensitivity of the clutch results in less tap breakage, fewer spoiled pieces and makes it easier to maintain high production schedules and output.

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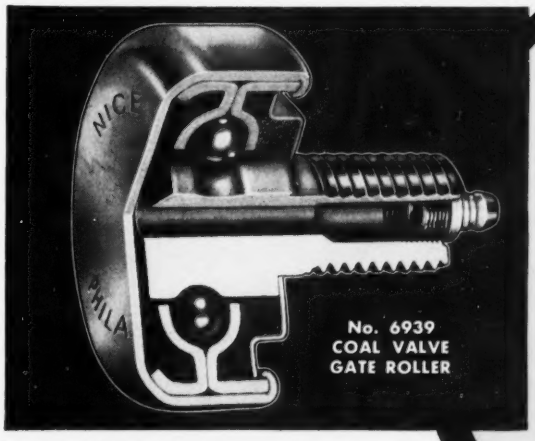
For more information on products advertised, use Inquiry Card, page 247

THE TREND *is to Product Improvement & Lower Consumer Prices...*



Once again forecasters and economists tell us that supply exceeds demand and only the alert and efficient will survive the "acid test" of the new Buyers' Market.

THE TREND, therefore, is to product improvement and lower consumer prices — and experienced NICE field men and factory engineers can help you accomplish these important objectives.

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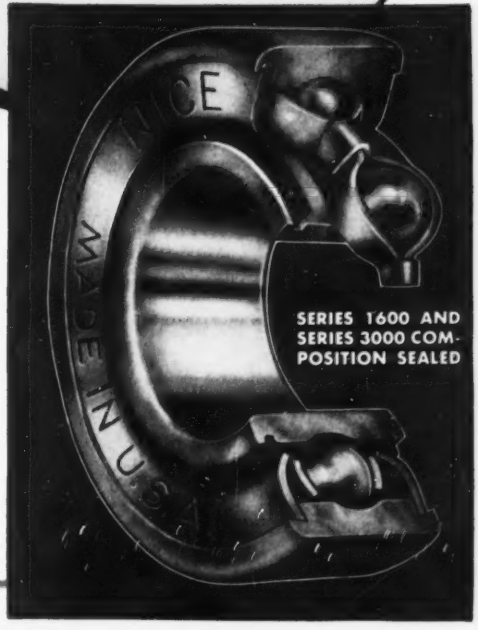
For complete information on the NICE LINE . . . . . write for Catalog No. 150.



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GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Besly-Welles Corp., Beloit, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial,

Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

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CHICAGO U. S. A.

OFTEN PAYS OUT ON THE FIRST JOB...

and gives additional years of "cost free" service.

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In savings of tooling costs, operator cost, power cost, and plant loading, as well as extra profits from more pieces per hour, Sheldon lathes often pay back their cost on a single run.

Sheldon lathes will work to the closest tolerances—have "Zero Precision" Taper Roller Bearings. They can take a healthy cut when operating at high speed direct drive—have double V-belts to the spindle. They will swing 10", 11" or 13" and have a 1⅝" hole through the spindle—have sufficient capacity for the great bulk of lathe work. Sheldon lathes have created a new factor for figuring machinery costs. They are tools you should know about.

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Farrel-Birmingham Co., 25 Main St., Ansonia Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Gear Grinding Machine Co., Detroit, Mich.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Gear Grinding Machine Co., Detroit, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

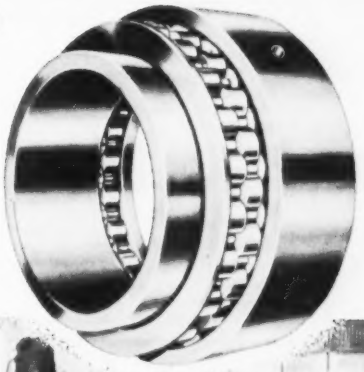
Allison Co., Bridgeport, Conn.
Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.

(*Continued on page* 378)

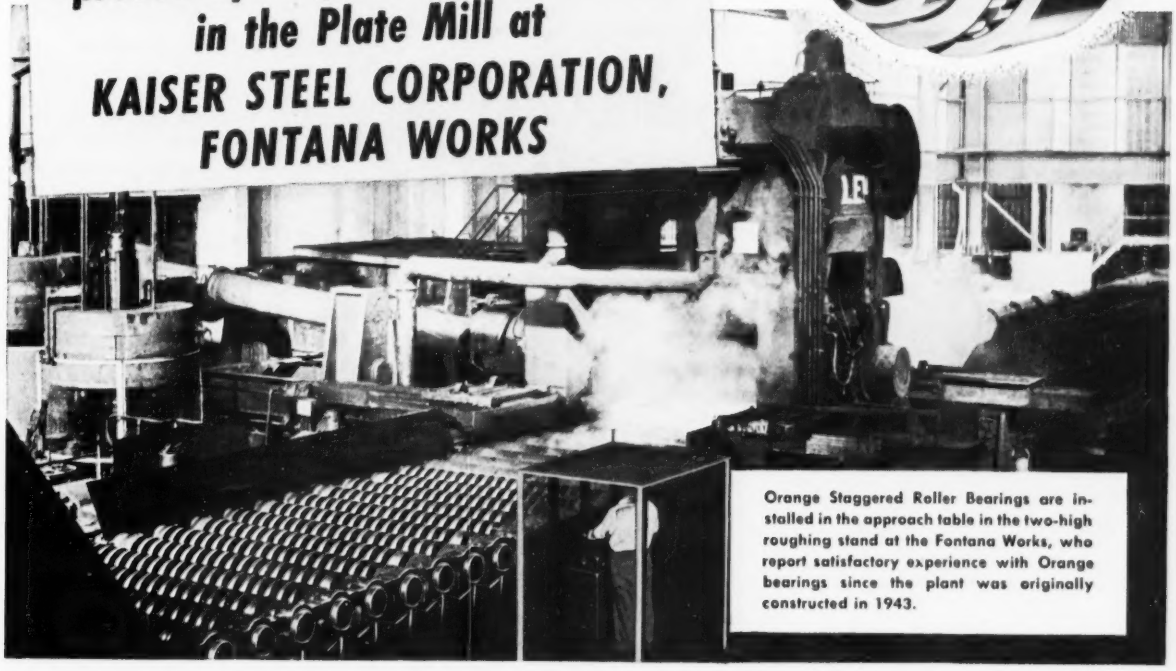
For more information on products advertised, use Inquiry Card, page 247

Exceptional load capacity and heavy-duty operation of

ORANGE "STAGGERED" ROLLER BEARINGS



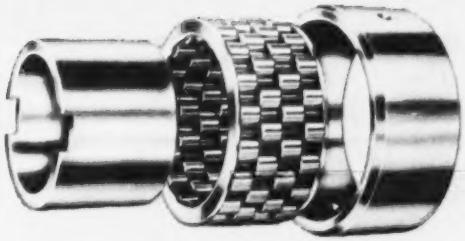
--proved by 10 years' Rugged Service in the Plate Mill at KAISER STEEL CORPORATION, FONTANA WORKS

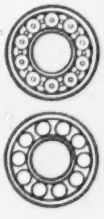


Orange Staggered Roller Bearings are installed in the approach table in the two-high roughing stand at the Fontana Works, who report satisfactory experience with Orange bearings since the plant was originally constructed in 1943.

The unique staggered design of Orange Staggered Roller Bearings distributes the load over many short rollers, instead of a few full length rollers. This eliminates skewing tendencies of long rollers—provides closer centers for maximum supporting area—assures smooth, precision running due to uniform distribution of load—and results in longer bearing life and extra margin of safety for your installations.

Orange Staggered Roller Bearings are available in a full range of standard sizes, fully interchangeable with other bearings in complete unit or component parts. Engineering service and stocks in all industrial centers. Submit your problems to our engineering department.





Shown are end views of an Orange "Staggered" Roller Bearing (upper) and a conventional roller bearing. Note how staggered roller design provides a multiplicity of contact points within the loaded zone.

Write for Engineering Data Book showing sizes, capacities, installation data, etc.

ORANGE ROLLER BEARING CO., INC., 552 Main Street, Orange, N. J.

Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., (Surface Grinder) 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

GROOVE PINS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

GROOVING Tools, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDENING, Surface Treatment

Electrolizing Corp., 1505 East End Ave., Chicago Heights, Ill.

HARDNESS TESTING INSTRUMENTS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HOISTS, Chain, Etc.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric

Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

(*Continued on page 380*)

MULTIPLY PROFITS BY MULTIPLE OPERATIONS

Part:

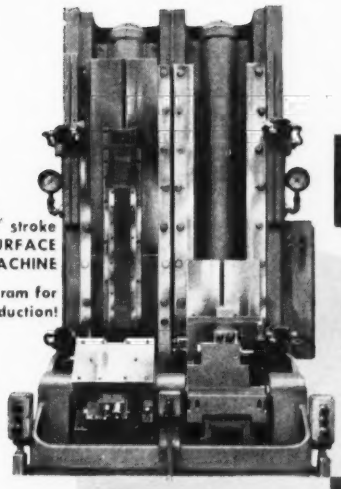
Steering gear housing. (Two different parts run on same machine with tool change only.)
Material: Malleable iron.
Operation: *Station* 1—Load and unload. *Station* 2—Drill (3) .368" holes; (1) .120" hole. *Station* 3—Combination spot face and chamfer (3) holes, drill (1) 23/32" hole for tapping. *Station* 4—Tap (3) 7/16"-14 NC-3 thread; tap 1/2"-14 NPSF thread.
Description: Millholland 4-station automatic index machine equipped with 4-station automatic index table, with 1 No. 5 Millholland Automatic Unit driven by 7-1/2 HP motor with 8-spindle ball bearing multiple head for drilling 5 holes and combination spot facing and chamfering 3 holes; 4-spindle tapper on right-hand column.
Operator loads part and pushes button initiating automatic cycle, unloads. Two parts machined at a time.

MILLHOLLAND ENGINEERED FOR MAXIMUM PRODUCTION

For special production machines, Millholland Automatic Units offer distinct advantages. These self-contained units, driven by individual motors, are readily adapted to a wide range of operations. Their full automatic cycle with interlocked controls permits several units to be grouped for simultaneous operations, or they can be mounted on other production machines and synchronized to perform additional operations. Millholland Automatic Units have proved themselves in 30 years of outstanding performance on all types of jobs. Get full details in Bulletin M-3.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd., Indianapolis 2, Indiana

For more information on products advertised, use Inquiry Card, page 247



10 ton, 42" stroke
DRV SURFACE
BROACHING MACHINE

Double ram for
fast production!

Send for Bulletin DRV-1

with this

RUGGED

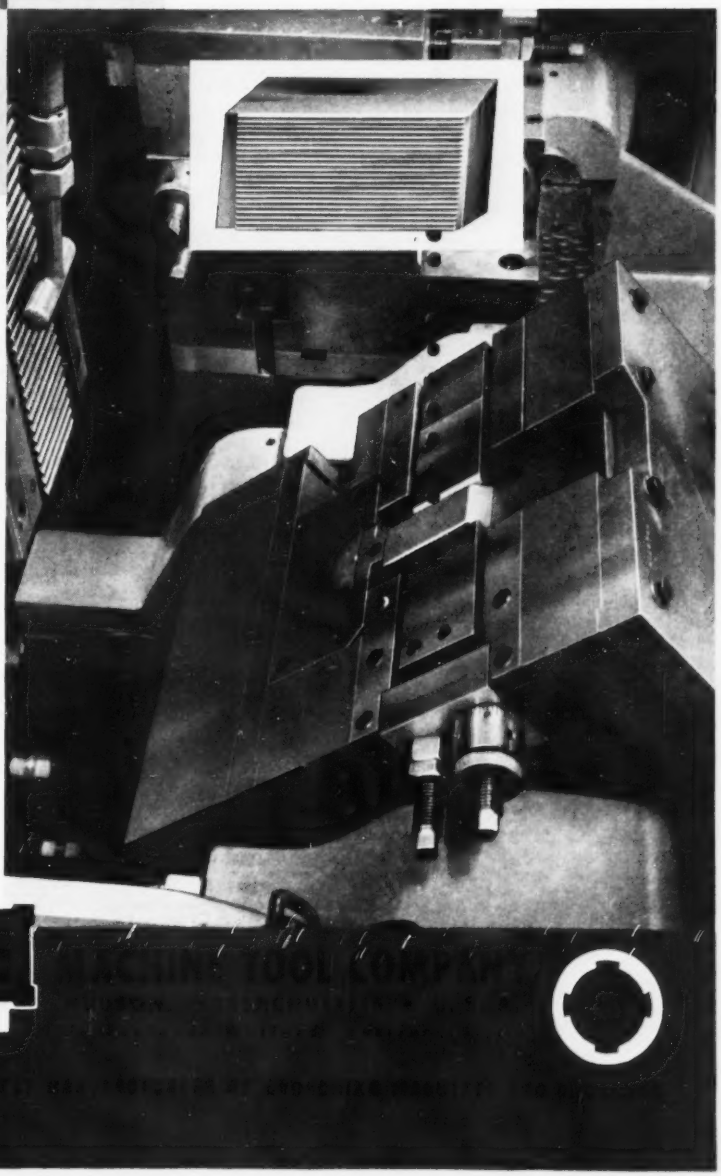
LAPOINTE

BROACHING MACHINE

and this

RIGID

TIP-DOWN* FIXTURE



you can

BROACH

400

high speed steel

MILLING CUTTER INSERTS

per hour!

...and here's the exciting news: 25 different sizes broached with minimum interchange of adapter blocks.

Exclusive LAPOINTE TIP-DOWN MASTER FIXTURE for safe and convenient handling of parts.

Parts are automatically clamped hydraulically, but manually released for reloading.

*Exclusive with LAPOINTE

HONING MACHINES, Internal (Cylinder)

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co. 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

HONING TOOLS AND FIXTURES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY Tools and equipment

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co. 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St. Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave. Mt. Gilead, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston, 35, Mass.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

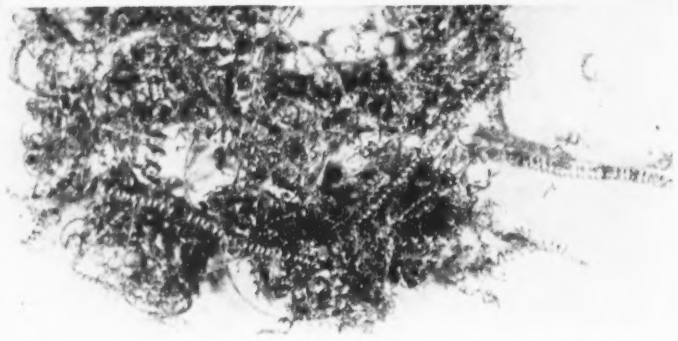
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co. 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp, P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford Conn.

(*Continued on page* 382)

Believe it or not . . .
THESE ARE HONING CHIPS



HONING MACHINES REMOVE METAL SO RAPIDLY THAT ONLY ROUGH BORING OR DRILLING IS NEEDED BEFORE HONING

Think of the terrific savings in time and labor! In Fulmer Honing Machines the spindle rotating and reciprocating mechanism provide honing of geometrical accuracy and any desired degree of smoothness. The rapid cutting action removes large amounts of material quickly, as shown in the photograph, with chips as long as 6 inches.

FULMER COMPLETE HONING EQUIPMENT Has EVERYTHING YOU NEED IN ONE "PACKAGE"—Honing Machines—Tools—Fixtures—Stones

• • •

WRITE for bulletin on HONING

C. ALLEN FULMER CO.

1231 FIRST NATIONAL BANK BLDG. CINCINNATI 2, OHIO

For more information on products advertised, use Inquiry Card, page 247

U.S. Army Photograph

Quick on the bull's-eye and stay there

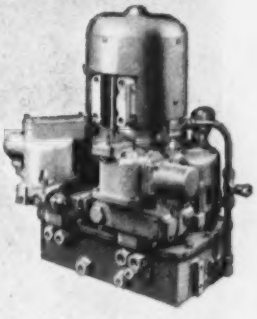
WITH OILGEAR FLUID POWER

Meeting speed, control and precise performance requirements of today's U. S. Tanks, Howitzers and Anti-Aircraft Guns is a "Natural" for Oilgear ANY-SPEED Fluid Power Components.

Gunners in Sherman, Pershing and Patton tanks experienced the advantages of rapid fluid power slewing and precise fluid power tracking of the turret and gun 360° in either direction. They appreciated the value of Oilgear fluid power that obeyed a light twist of the wrist. Likewise, those manning America's most effective 40 mm anti-aircraft guns, recognized the importance of automatic, self-synchronizing Oilgear fluid power drives for rapid slewing and precise tracking of the carriage 360° in either direction and the rapid, accurate elevating and depressing of the gun for quick homing on the target and following it.

Therefore, when today's new combat vehicles with far greater fire power and accuracy were planned, Oilgear ANY-SPEED Fluid Power Drives were a "Natural" for both turret traverse and gun elevation. They met the demands for accurate control over speed ranges up to 4000:1. They provided unbelievably low tracking speeds under precise response without overrun or drift. They stayed on the target for repetitive shots. No wonder, one men's magazine calls the new Oilgear equipped M47 "the sharpest shooting tank anywhere today." That's why Oilgear ANY-SPEED fluid power drives are a "Natural" on the wide variety of U. S. combat vehicles.

Don't you think it is time for you to look with wide open eyes at Oilgear Fluid Power Pumps, Motors and Transmissions for **your** machines... to better the performance of an already good machine? To solve a seemingly "impossible" design problem? To synchronize machine units easily and economically? To weed out trouble and cut maintenance and down time to a surprisingly low level? Counsel with an Oilgear Engineering Representative will cost you nothing, may benefit you greatly. THE OILGEAR COMPANY, 1569 W. Pierce St., Milwaukee 4, Wisconsin.



OILGEAR POWER PACK

Self-contained unit used in present day tanks and howitzers. Consists of electric drive motor, two Oilgear two-way variable delivery pumps (or generators), oil reservoir and integral closed system controls for turret traverse and gun elevation. Supplies fluid power to Oilgear hydraulic drive motors.

OILGEAR

OILGEAR

INDICATORS, Test

Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C. Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic

Baldwin-Lima-Hamilton Corp., Philadelphia 42
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Northwestern Tool & Engrg. Co., 117 Hollier Dayton, Ohio.

JIG BORER

See Boring Machines, Jig.

JIGS AND FIXTURES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Northwestern Tool & Engrg. Co., 117 Hollier Dayton, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS

See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS

Brown & Sharp Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.).
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago

LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hendey Machine Co., Inc., Torrington, Conn.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

(Continued on page 384)

at one of the world's largest automotive plants 37¼ seconds for 28 operations

JOB FACTS:

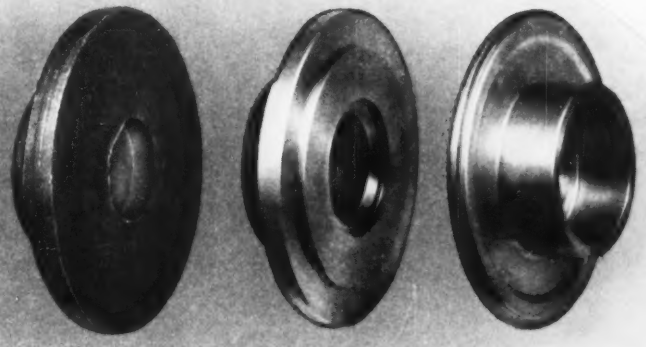
PART.....Torque Impeller Hub.
SIZE.....4" diam. 1¼" long.
MATERIAL.....Steel forging, SAE 1146 annealed
MACHINES: 6 inch model RPA-8 Acme-Gridley Chucking Automatics.

1ST MACHINE, with double index and duplicate tooling finishes 2 pieces per cycle—each with 11 identical operations. All carbide tooled.

Machine Time: 22½ seconds—320 per hour.

2ND MACHINE, single index with one set of tools completes opposite side to 17 operations. All carbide tooled.

Machine Time: 26 seconds—138 per hour.



WITH 100% CARBIDE TOOLING ON 8-SPINDLE

Acme-Gridley Chucking Automatics

IN this most competitive big business all planning must be toward higher consumer acceptance in both quality and purchase price—and leave a profit for the effort.

All three of these prime essentials begin with small parts such as these and hundreds of others made on multiple spindle chucking automatics.

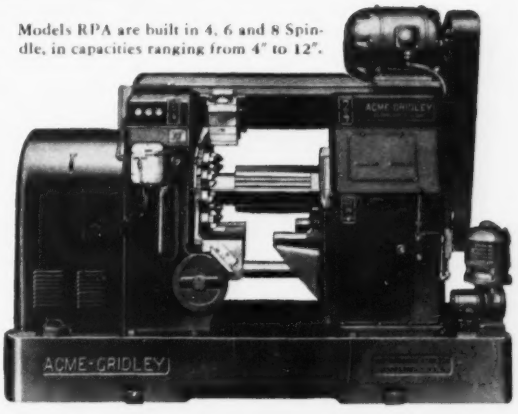
Alert, continuous and critical study is given to the most minute detail for manufacturing improvements, accepting only those which will:

- **save a fractional second in time per piece**
- **avoid rehandling on extra machines**
- **release valuable floor space**
- **relieve costly man-hours for other work**

—all to the end of achieving better components at lowered factory cost.

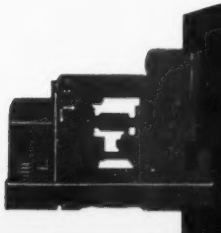
For more than 20 years Acme-Gridley machine design engineers and tooling specialists have helped meet these vital needs—by improving basic machine stamina, by ingenious applications of fastest cutting carbide tools, by simplifying operator effort. All of which applies to multiple chucking operations and to bar machine performance.

Models RPA are built in 4, 6 and 8 Spindle, in capacities ranging from 4" to 12".



Regardless of the particular kind of mass production parts, let us show you how to put Acme-Gridleys to work in your plant—MORE PROFITABLY.

Remember—your market also must be protected against competition if you expect to make a profit.



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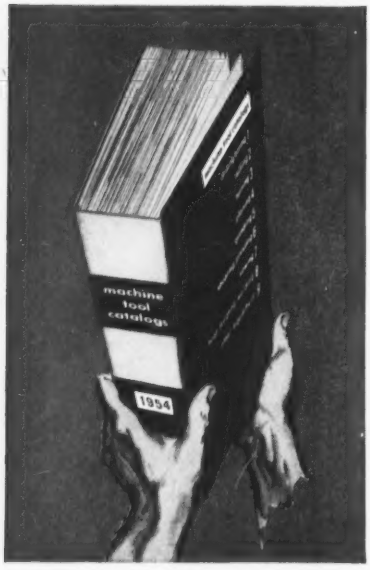

"... a great time-saver"

These manufacturers' catalogs are instantly available in Section 6 of your Machine Tool Catalogs:

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Dake Engine Co.	Rodgers Hydraulic Inc
General Mfg. Co.	Struthers-Wells Corp.
Innocenti	Thomas Machine Mfg. Co.
Johnson Machine & Press Corp.	Varson Allsteel Press Company
	Wales-Strippit Corp.

***ALSO:* The following catalogs, in other sections of your Machine Tool Catalogs, contain information on shearing and pressing machinery:**

Armstrong-Blum Mfg. Co.	Greenlee Bros. & Co.
Bryant Chucking Grinder Co.	Hall Planetary Co.
Cincinnati Milling Machine Co.	Landis Tool Co.
Colonial Broach Co.	Norton Co.
Consolidated Machine Tool Corp.	Snyder Tool & Engineering Co.
Gisholt Machine Co.	Sundstrand Machine Tool Co.
	Taft-Peirce Mfg. Co.

In other sections of the File you will find additional catalogs containing useful information on a wide range of machine tools and accessories.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street,
New York 18, N. Y.

Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHE CONVERTER

Master Mfg. Co., Hutchinson, Kansas.

LATHES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St. Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls, Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford Ill.

LATHES, Duplicating

H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St. Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Halpern, Wm., Co., Inc., 100 Stevens Ave., Mt. Vernon, N. Y.
Hendey Machine Co., Inc., Torrington, Conn.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Corp., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(*Continued on page 386*)

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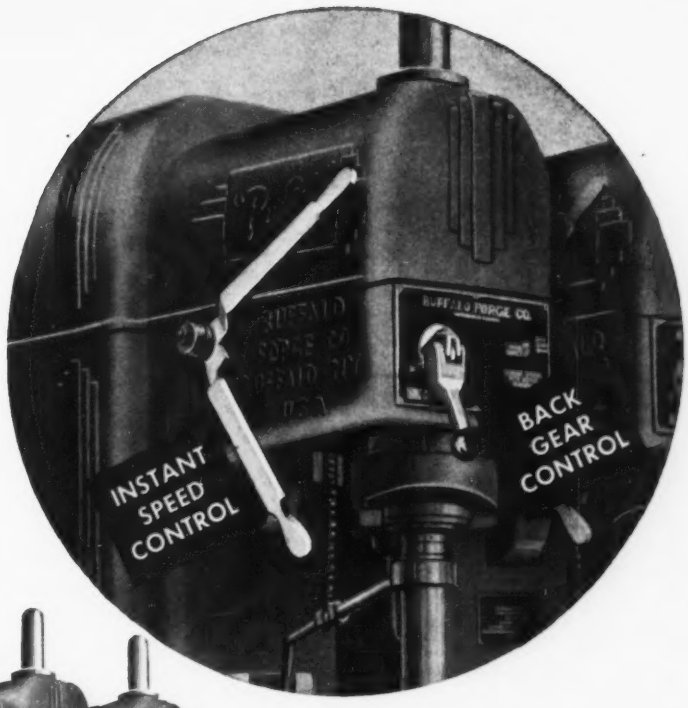
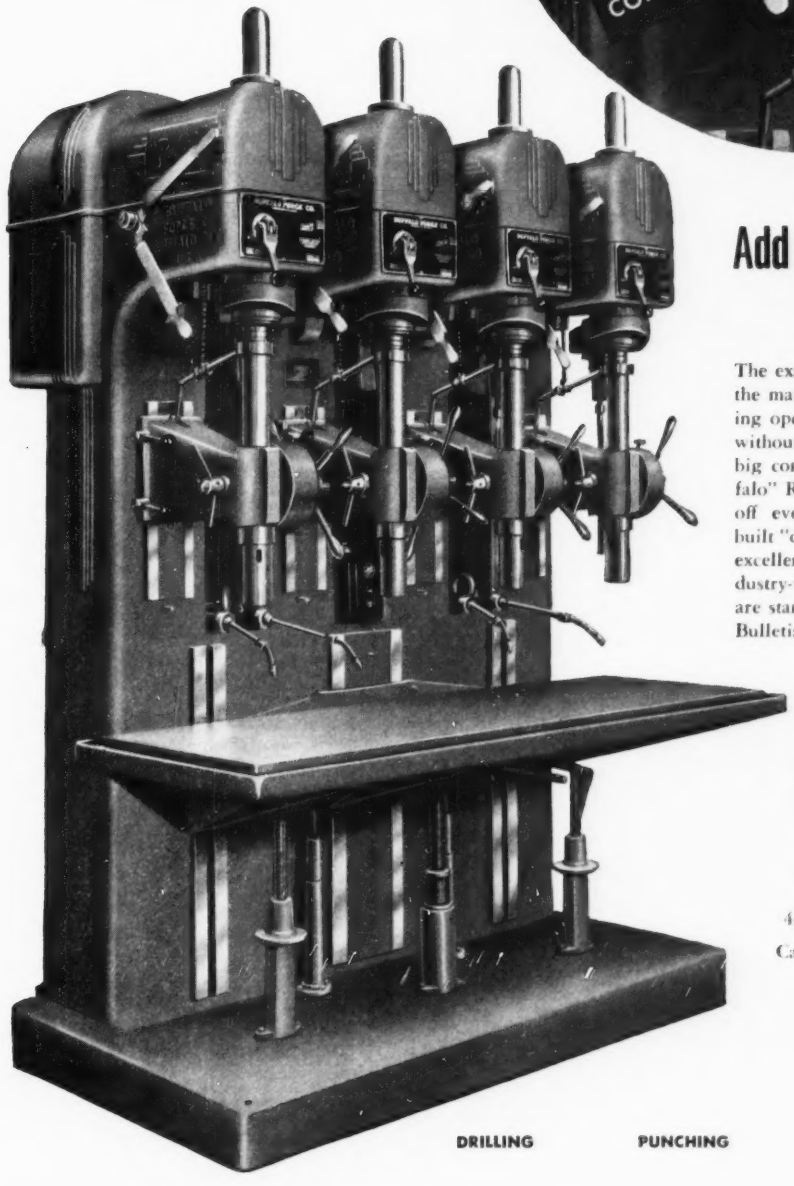
These 2 LEVERS on the RPMster





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The exact required speed for the size of drill, the material hardness or the tapping or reaming operation you're about to start—instantly, without shutting off the motor! It's not only a big convenience to the operator of the "Buffalo" RPMster, but it shaves valuable minutes off every operation. These heavy, ruggedly built "drills with 1001 speeds" are setting some excellent profit-drilling records in shops industry-wide. Back gearing and power feed, too, are standard equipment. Better write today for Bulletin 3257A for the facts on these machines that all but think for the operator!

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440 Broadway, Buffalo, New York

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Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom
See Lathes, Engine and Toolroom.

LATHES, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

LUBRICATING SYSTEMS
Farvel Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Omerud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

(*Continued on page* 388)

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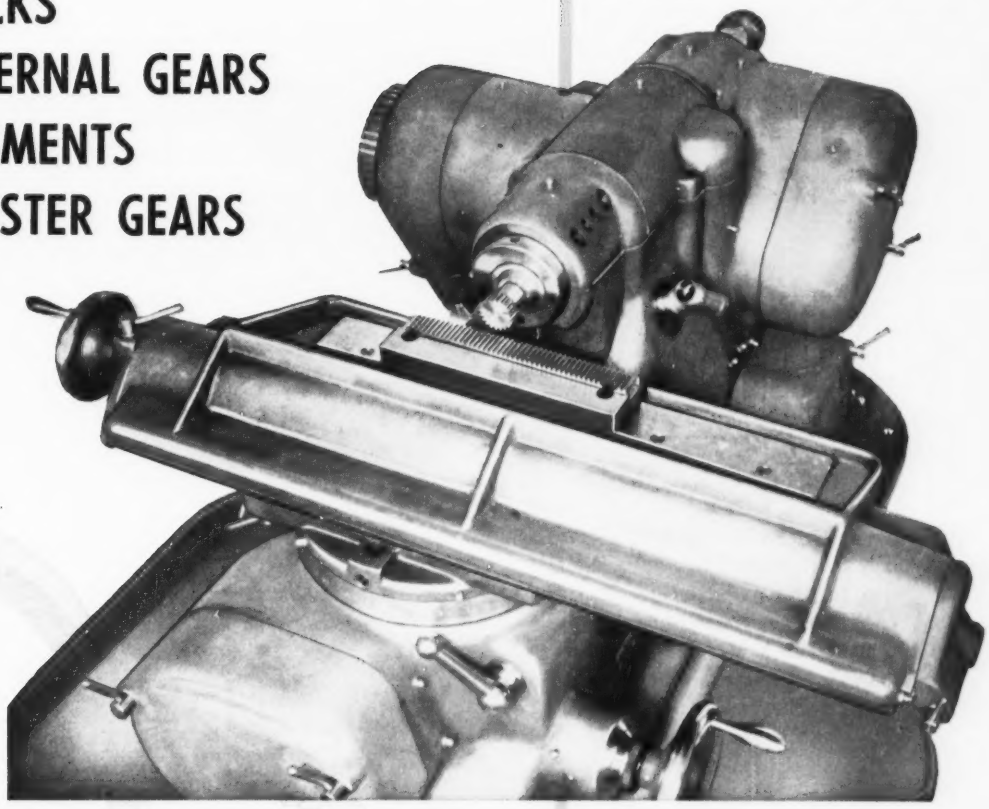
MIKRON *fine pitch*

RACK & GEAR CUTTER NO. 134—

Another machine in the MIKRON line–*Controlled Accuracy. High Finish, Ease of Set-Up.*

- **RACKS**
- **INTERNAL GEARS**
- **SEGMENTS**
- **CLUSTER GEARS**



THE precision cutter shapes as it generates tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.

WORK PIECE CAPACITY

RACKS: (Straight or Skew) to 36" long x 1" wide.
SEGMENTS & CLUSTERS: to 3⅛" dia. x 1" wide.
INTERNAL GEARS: to 4" dia. x 1" wide.

RUSSELL, HOLBROOK & HENDERSON, INC.

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Can You Check YES to these five questions?

- ☐ Do the gears you use have surface-hardened teeth?
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If not, you should use—

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ARMORED GEARS are made only by PITTSBURGH GEAR from an exclusive formula perfected by PITTSBURGH engineers. It covers metal, machining, and a method of heat-treating that hardens the wearing surfaces but leaves the core tough, ductile, and shock-resistant.

All PITTSBURGH gears are made to extremely close tolerances to fit perfectly right from the start. They are guaranteed to give you five times the life of untreated gears, one to one and one-half the life of oil-treated gears, and equal or longer life than any other gear in identical service.

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MANDRELS
See Arbors and Mandrels.

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MASKS, Painting
Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MEASURING MACHINES AND INSTRUMENTS, Precision
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

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METERS
See Recording Instruments.

MICROMETERS
Alina Corp., 401 Broadway, New York 13, N. Y.
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Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

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Cincinnati Milling Machine Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Groton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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Halpern, Wm., Co., Inc., 100 Stevens Ave., Mt. Vernon, N. Y.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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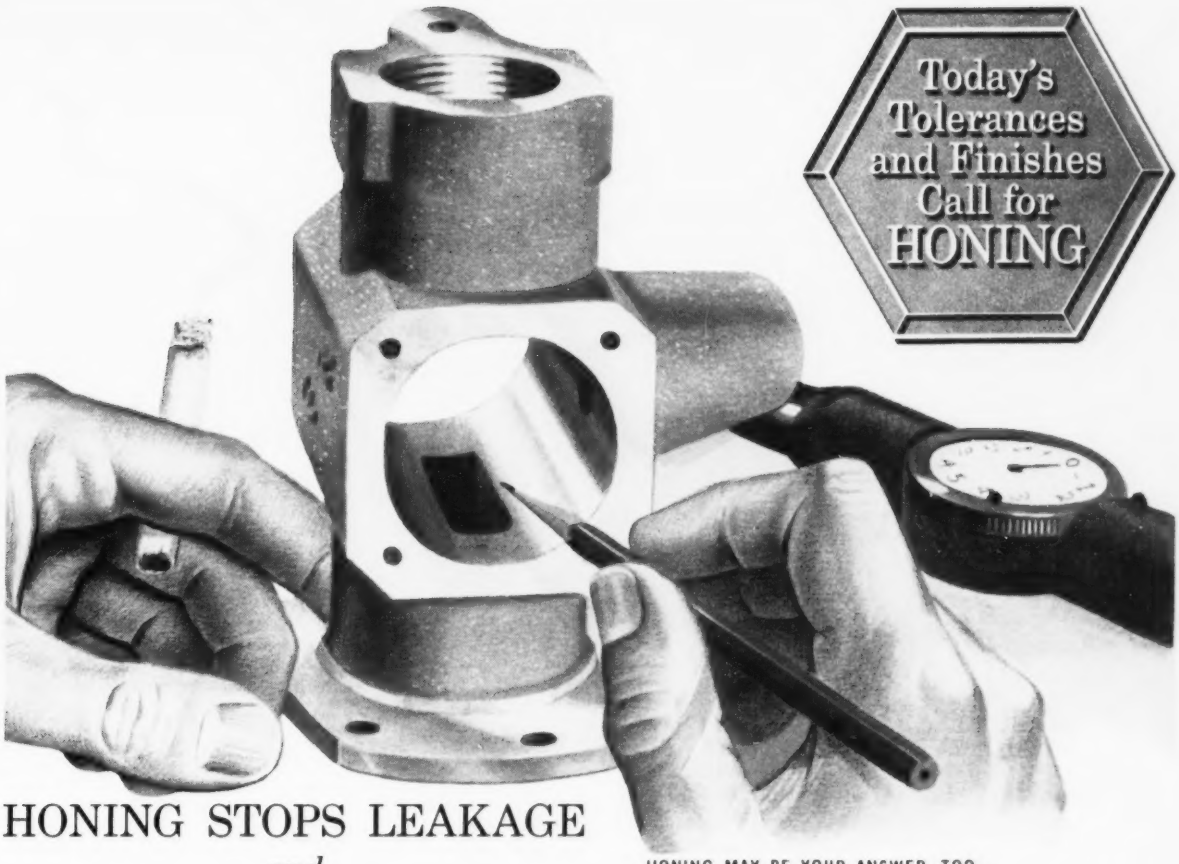

Today's Tolerances and Finishes Call for HONING

HONING STOPS LEAKAGE
and
CUTS PRODUCTION COSTS

Makes High Quality, Low Cost Hydraulic Controls Possible

PROBLEM: At Fluid Controls, Inc., a tolerance of plus zero minus .0001" is specified on the $2\frac{1}{2}$" I.D. of this aluminum valve body—with no washout allowed around the ports. This precision is necessary to reduce fluid leakage to a minimum. A high production rate is necessary to keep costs down.

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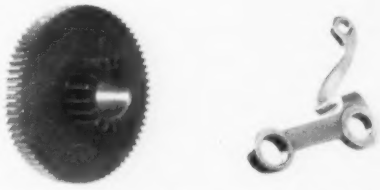
HONING MAY BE YOUR ANSWER, TOO ...
Just as Sunnen Honing was the solution to this valve problem, it might also help improve *your* competitive position—could make your products operate smoother, last longer, with increased reliability—or make possible cooler running, and higher speeds and bearing loads in your machines.



From exact sizing of precision parts in soft or hard materials, to de-burring in stampings and forgings, Sunnen Honing Machines have proved the answer to many production problems. Surface finish can be held to 2 micro-inches RMS in hardened steel. Diameter range is $\frac{1}{8}$" to $2\frac{5}{8}$". Average installation is under $1,000—delivered and in operation within three weeks. Our field engineers continue to serve you year-'round, without charge.

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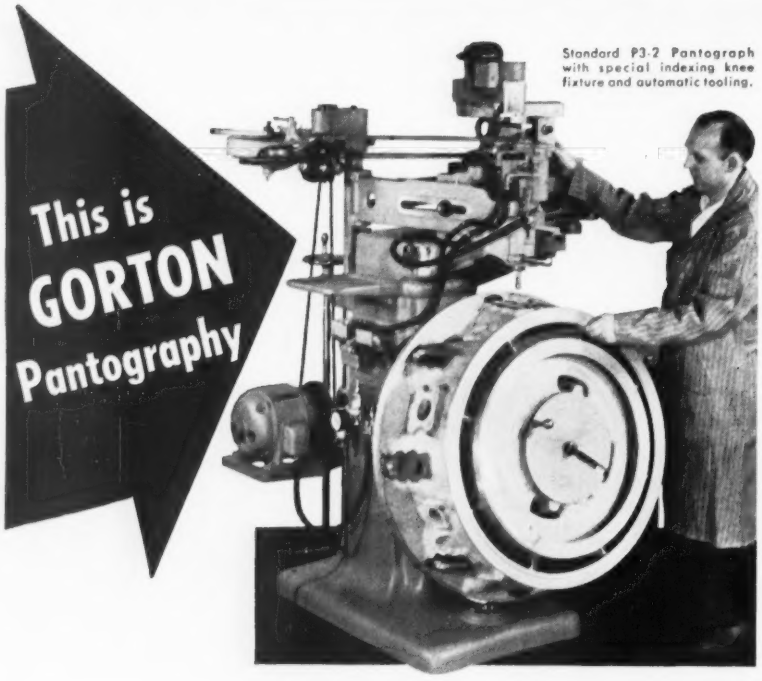

Standard P3-2 Pantograph with special indexing knee fixture and automatic tooling.

...Ready to Help You

Photo shows a standard P3-2 profiling ports in an aircraft part, a large aluminum-alloy casting. The sides of each port are parallel; one end has a true radius, the other end is parabolic. A combination of other methods would do the cutting in hours, but the P3-2, with an automatic cutting cycle, finishes each port in 2.3 minutes.

Improve Production and Lower Costs

Gorton tracer-controlled equipment does efficient profiling, routing, die sinking, mold cutting, counterboring, chamfering, grooving, graduating, engraving and many other standard or special operations. You can expect high accuracy and high surface finish, whether your work involves metals or plastics in flat, uniformly curved, cylindrical or irregular shapes.

Enlarged templates, masters or patterns, all quickly and easily made, give Gorton Pantographs advantages of increased accuracy through reduction ratios. Work pieces range in size from the diameter of a dime to 10 feet. Cutting cycle is accomplished manually or automatically.

Fill out and mail the coupon for your copies of the Gorton catalog and the informative booklet, "Pantography."

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A 7786-3

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Fray Machine Tool Co., 151 W. Windsor Rd., Glendale 4, Calif.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st. St., Milwaukee 14, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

(*Continued on page* 392)

For more information on products advertised, use Inquiry Card, page 247

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Murray Hill, N. J.

Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R. Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

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Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Groton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

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Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK

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Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

(*Continued on page 394*)

For more information on products advertised, use Inquiry Card, page 247

NOW TOOL UP FOR MULTIPLE SAVINGS

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AIR engineering

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MULTIPLE NUT-RUNNERS

new idea!

Note in this plant, the Model YD4A Nut Runner in the foreground is tightening differential bearing caps for the machining operations. In the background, a Model YG4A is *removing* the cap screws prior to final assembly. Each is handling 4 operations at once—substantial saving against single power tool or one-at-a-time operation by hand!

2 to 10 nuts--or more . . . are driven simultaneously!

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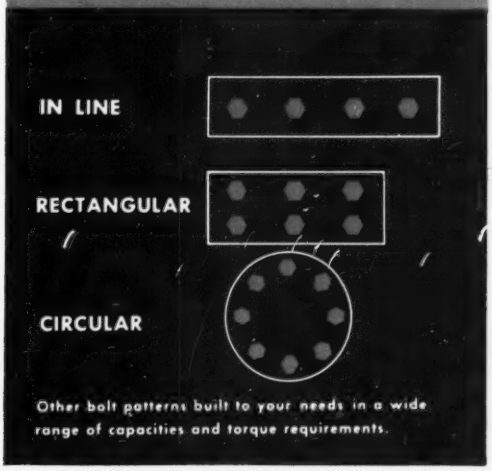
in typical bolt patterns like these:



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Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motor Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

MOTORS, Hydraulic

Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

Nilson Machine Co., A. H., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel

International Nickel Co., Inc., 67 Wall St., New York, N. Y.
Wales-Strippit Corp., N. Tonawanda, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL CUPS

Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL EXTRACTORS AND CLEANERS

De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS

Wicaco Machine Co., Stenton Ave. and Louden St., Philadelphia, Pa.

OIL-HOLE COVERS

Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL SEALS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting

See Cutting and Grinding Fluids.

OILS, Lubricating

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Spelial

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PAINTING EQUIPMENT, Spray

Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis 7, Ind.

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

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American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves, Detroit, Mich.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTIC AND PLASTIC PRODUCTS

Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

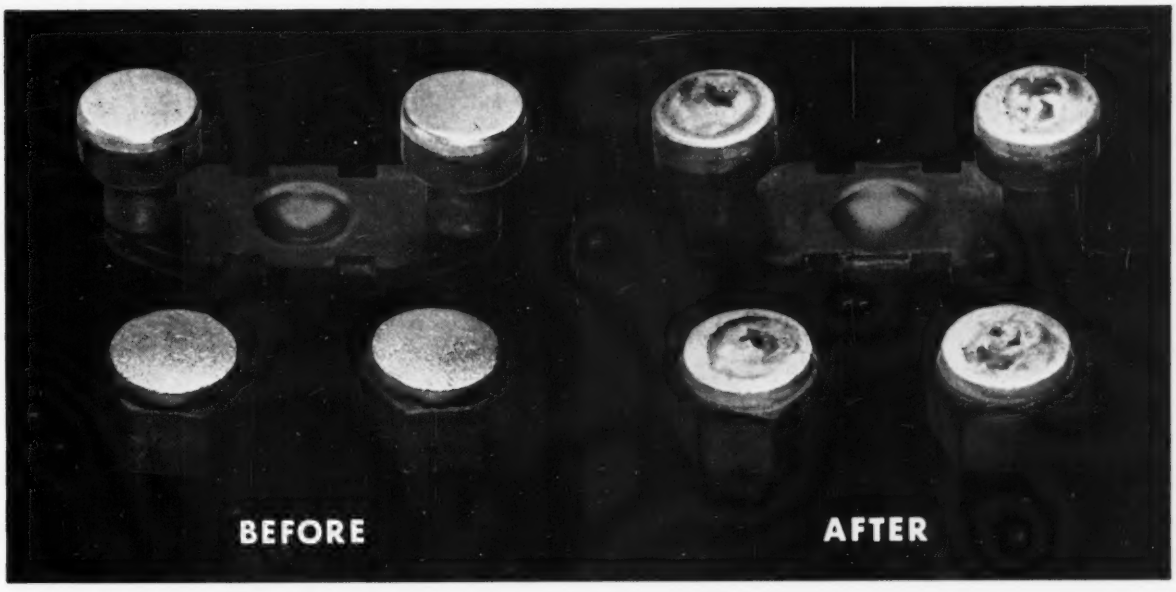
PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

(Continued on page 396)



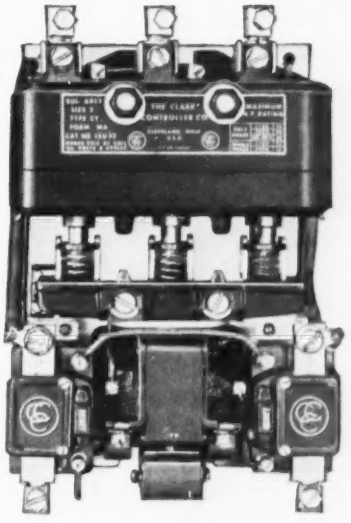
PROOF OF LOW MAINTENANCE ON CLARK TYPE "CY" STARTERS

These unretouched photos show contact tips from a CLARK Bulletin 7707 contactor—the contactor used in the standard Bulletin 6013 size 2 AC Motor Starter—as they looked before and after a year of hard use.

The contactor is in service at Cleveland Hone and Manufacturing Company, on a special transformer and rectifier circuit used in processing automotive parts. The tips shown right above were removed from the contactor after 12 months of steady service, often operating as frequently as 5000 times per hour.

Note that slight discoloration and minute pitting are the only evidence of wear. They require no cleaning, dressing or filing, and are in condition to give many more years of dependable service.

The secret of long contact life in the CLARK Type "CY" Starter is its exclusive arc-quenching principle, using strong multi-turn magnetic blowouts and double-break contacts. Forced rotation causes the arc to move continually on the contact surfaces, distributing the heat and preventing pitting or "build-up" at any one point. Result: extremely effective arc interruption, and greatly reduced wear on tips.



CLARK Type "CY" Starters include many more features for dependable service and reduced maintenance. Let us tell you the complete story.

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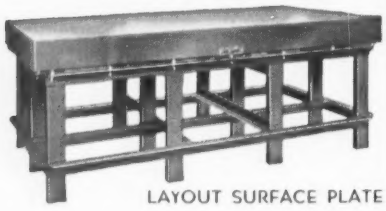

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Jarvis, Charles L., Co., Middletown, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Air

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilburn Ave., Chicago.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Clifton Hydraulic Press Co., Clifton, N. J.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St. Chicago 44, Ill.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

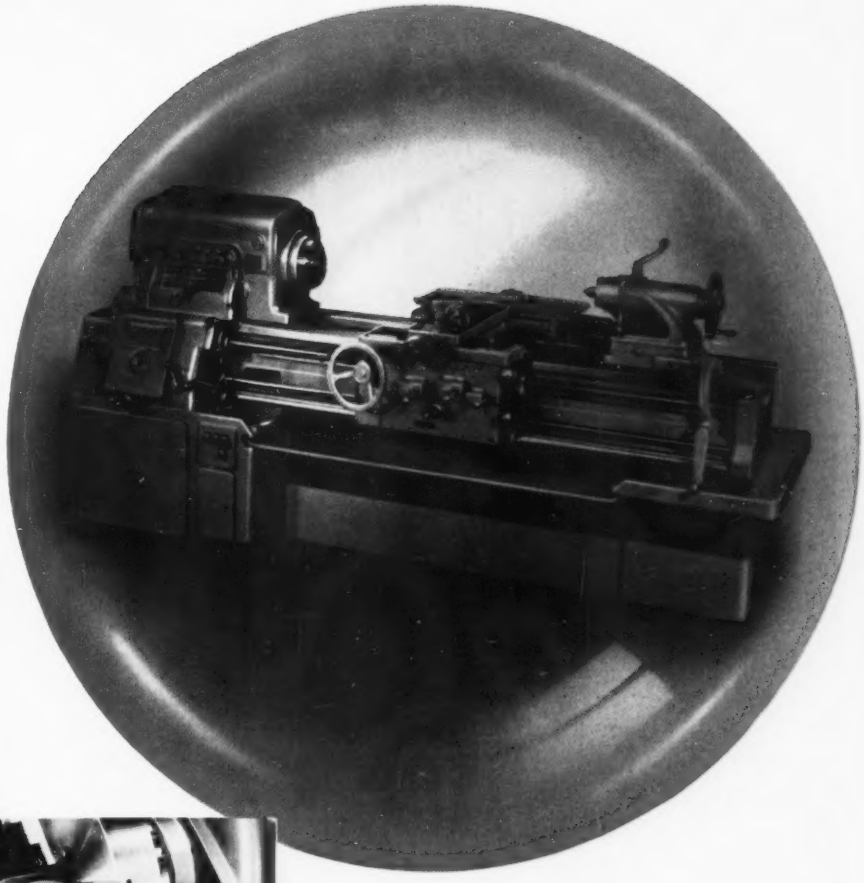
PRESSES, Sheet Metal Working

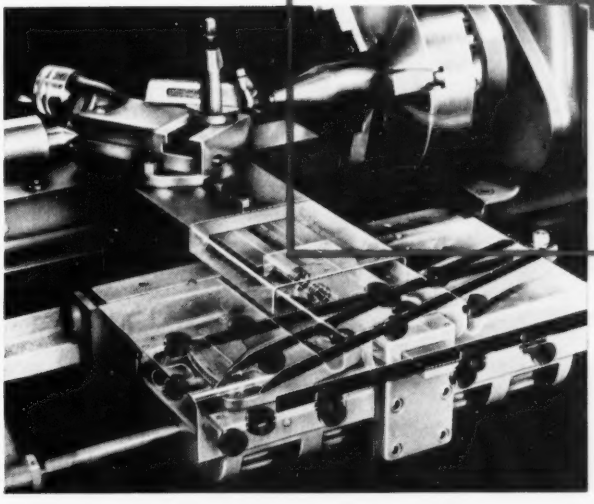
Allen, Alva F., Box 426, Clinton, Mo. (Bench)

(*Continued on page 398*)

For more information on products advertised, use Inquiry Card, page 247

BALL BEARINGS make a product BETTER





Twenty New Departure ball bearings are used in the Monarch Machine Tool Company's antifriction bearing taper attachment. There are 12 single-row bearings, 8 double-row bearings. All are permanently lubricated.

Many advantages of the Monarch lathe taper attachment are—according to its maker—the result of New Departure **ball** bearings. For by their use, backlash, friction and lost motion are almost entirely eliminated . . . smoother, more accurate tapers are possible. And Monarch's taper attachment takes heavy cuts even when boring or turning acute angles, for **ball** bearings give rigid support under both radial and thrust loads.

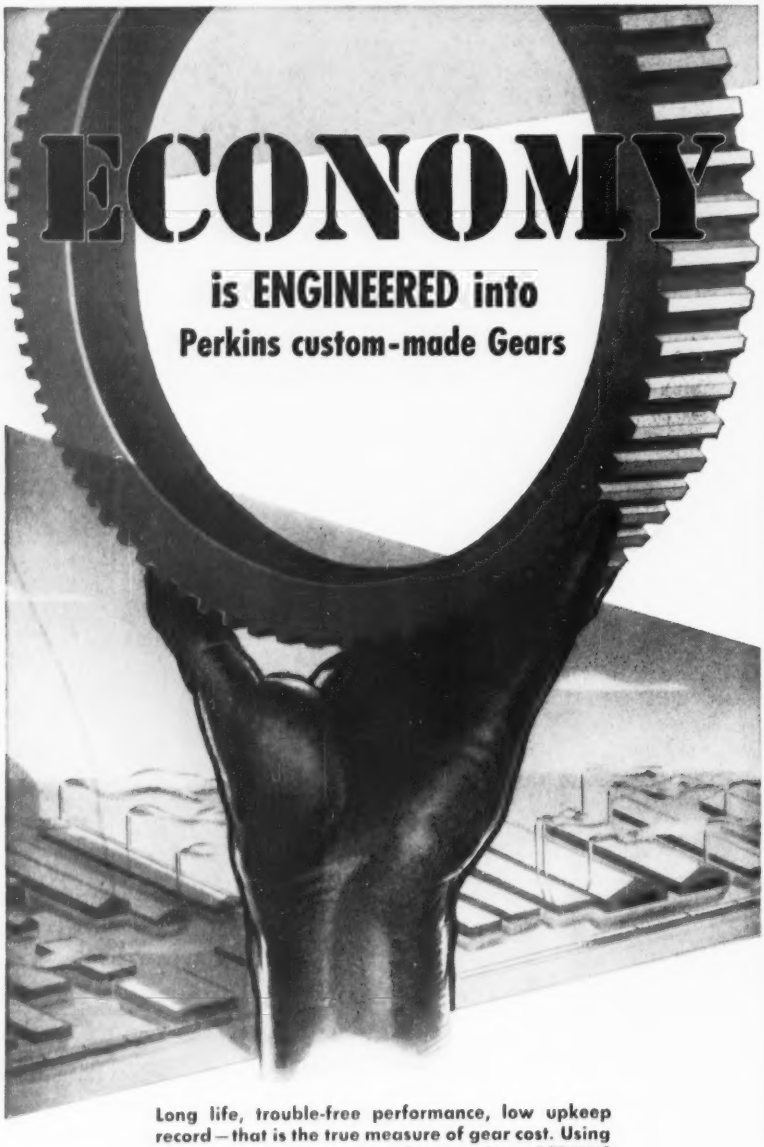
Call your New Departure sales engineer. Have him show you how New Departure ball bearings make a good product *even better!*

NOTHING ROLLS LIKE A BALL

NEW DEPARTURE

BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT
Plants also in Meriden, Connecticut, and Sandusky, Ohio



Long life, trouble-free performance, low upkeep record—that is the true measure of gear cost. Using those factors as a means of comparison, PERKINS GEARS cannot be surpassed. As a result, you will find PERKINS PRECISION GEARS in the power transmission systems of the finest products made by industry throughout the United States.

As one of the country's leading gear engineering organizations—solidly backed by a tradition of New England craftsmanship, we are able to produce—to your specifications—any size gear, in any material and in any quantity. Ask us to quote on your requirements.

PERKINS MAKES: helical gears, bevel gears, sprockets, ratchets, worm gears, spiral gears, spur gears with shaved or ground teeth, ground thread worms.

NOTE 1: A new product is the **Perkins Precision Spring Coiler.** This coiler (patent applied for) turns out precision springs—any type, shape, size, from wire sizes .005 to .125.

2: Another new product—the **Perkins "Bendit 15"**—a patented metal forming machine bends and shapes sheets, rods, strips tubing into innumerable complex as well as simple forms that would be difficult or impossible to make by other means. Eliminates need for expensive tools or specialized skills. Ht. 47", net wt. 200 lbs. Write today for descriptive catalogs, prices etc.

PERKINS Machine & Gear Co.
WEST SPRINGFIELD, MASSACHUSETTS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farguhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Sales Service Mch. Tool Co., 2363 University Ave., St Paul, Minn.
Verson Allsteel Press Co, 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farguhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, (Hydraulic) 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa., (Lathe).

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N.Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Mchry. Co., Inc. (and affiliated companies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pines Engineering Co., Inc., Aurora, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

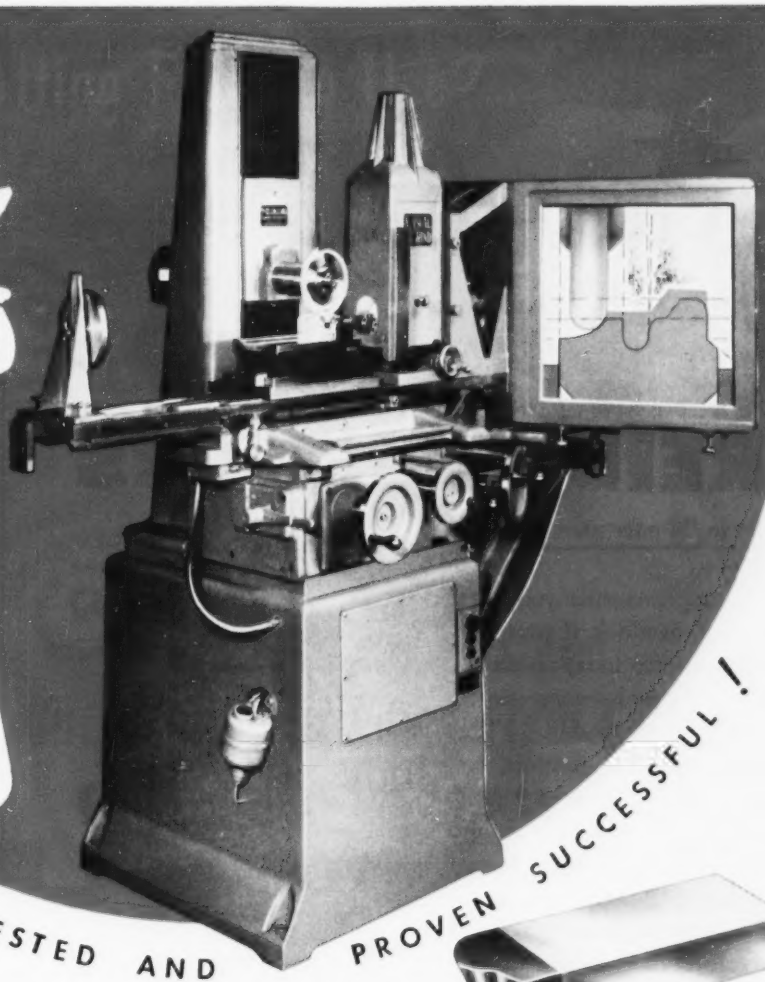
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

(*Continued on page* 400)

For more information on products advertised, use Inquiry Card, page 247

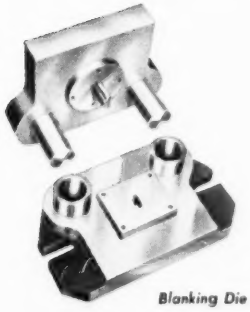
Positive Results with VISUAL GRIND

TRADE MARK

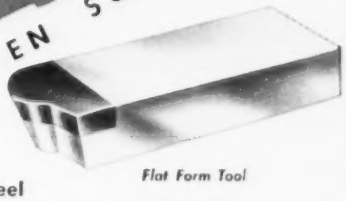


TESTED AND PROVEN SUCCESSFUL !

Progressive Die



Blanking Die



Flat Form Tool

Circular Form Tool

Dovetail Tool

Here is precision contour grinding at its best. Steel and tungsten carbide form tools, die sections, templates and related items are efficiently processed in dependable, economical fashion. Our basic magnetic chuck work-holder affords positive positioning yet with flexibility for cam, circular and index grinding with the proper fixtures. Workpiece quality is controlled visually at all stages, either while using pre-dressed grinding wheels or when generating the required contour by means of successive, controlled movements. Durable construction around precision optics insures rigidity and long life.

Ask for Bulletin "M-4"

VISUAL GRIND

THE CLEVELAND GRINDING MACHINE COMPANY

1643 EDDY ROAD • CLEVELAND 12, OHIO

New Possibilities in Optical Grinding

Grinders have changed . . .

IT'S TIME YOU CHANGED GRINDERS

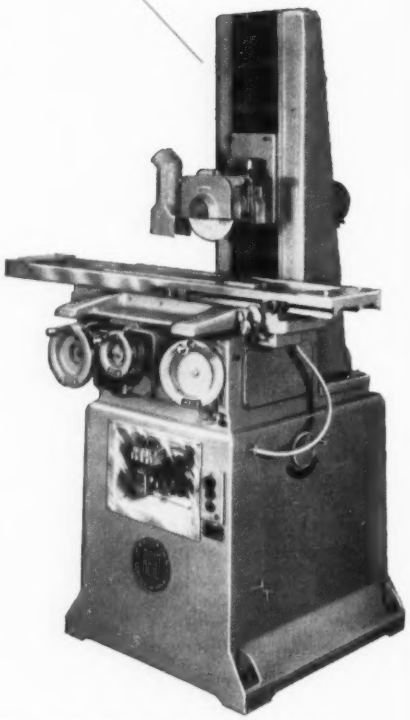
REID GRINDERS

built in '54 offer more improvements . . .

. . . improvements you can't afford to overlook, if your toolroom is to meet today's precision tooling demands—competently, quickly and profitably.

Finger-tip level controls for easier operation; one-piece column casting mounted *on* the base for maximum rigidity; hand-scraped ways for accuracy; telescoping dust plates for protection of vertical and cross feed mechanisms — these are but a few of the many improvements designed by our engineers to make Reid Grinders a standard of precision and dependability.

If your toolroom still harbors a surface grinder like those above, for the sake of efficiency,



PLAN NOW FOR REPLACEMENT!

Condensed specifications — Model 618V
Capacity: 6" x 18" x 17¼" (spindle center to table)
Work table: 51" x 8"
Power-feed table: variable, 12 to 35 ft./min.
Standard wheel: 7" x ½" x 1¼"
Weight: 2100 lbs. Floor space: 71" x 43½"

see our catalog in MACHINE TOOL CATALOGS or write for copy

Please request Catalog 618-2

Reid Brothers Company, Inc.
BEVERLY, MASSACHUSETTS

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Ill.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Famco Machine Tool Co., 3134 Sheridan Rd., Kenosha, Wis.

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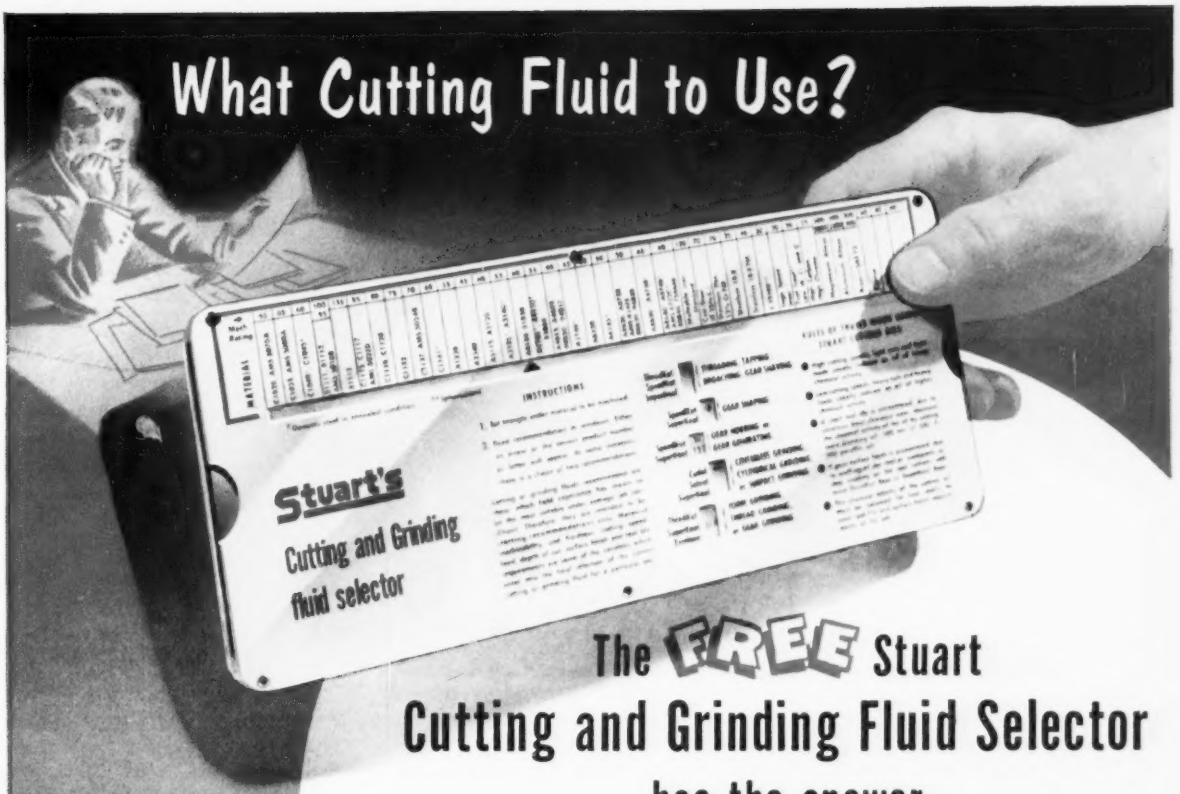
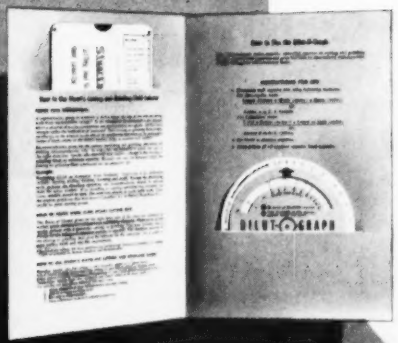
For more information on products advertised, use Inquiry Card, page 247

What Cutting Fluid to Use?



The FREE Stuart Cutting and Grinding Fluid Selector has the answer



There is a right cutting fluid for every cutting and grinding job . . . and sometimes it's hard to know where to start in selecting one. For that reason Stuart has developed this FREE Cutting and Grinding Fluid Selector. It's a ready reference that recommends cutting and grinding fluids that field experience has shown to be most suitable under average job conditions. In your hand it's a quick guide to starting recommendations for any job.

Send for your Stuart Cutting and Grinding Selector today. Remember, more than a "coolant" is needed . . . let the Stuart Selector help you get the right cutting fluid to give you the best results.

Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder

This handy folder contains a Stuart Cutting and Grinding Fluid Selector and a Dilut-O-Graph . . . a circular slide rule that makes the diluting of cutting fluids quick and easy. They are double-barreled assurance of having the right cutting fluid on all jobs.

send today

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL

D. A. STUART Oil Co. Ltd.
2739 S. Troy St.
Chicago 23, Ill.

Please send the Stuart Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder.

Name_____

Title_____

☐ Have Stuart Representative Call

More Than a "Coolant" is Needed

D. A. Stuart Oil Co.

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2727 S. Troy St., Chicago 23, Ill.

In Canada: Canadian D. A. Stuart Oil Co., Ltd.
3575 Danforth Ave., Toronto

ELECTRIC MOTOR BEARINGS over 350 types
GRAPHITED BEARINGS over 200 sizes
remember 90%
THE magic NUMBER WITH JOHNSON BEARINGS
OVER 90% of your sleeve bearing applications . . . 90% plus . . . can be fitted from standard, stock size Johnson Bearings. Your local Johnson Distributor can supply you from stock. This standard line includes over 920 General Purpose Cast Bronze Bearings, 200 Graphited Bearings, 385 Self-Lubricating Powder Metallurgy Bearings, 350 Electric Motor Bearings, Johnson Universal Bronze Bars and Babbitt Metal. Whether you need bearings for original equipment, replacement or maintenance, first investigate Johnson Sleeve Bearings.
UNIVERSAL BRONZE BARS over 400 sizes
LEDALOYL BEARINGS over 385 sizes
GENERAL PURPOSE BEARINGS over 920 sizes
JOHNSON BRONZE COMPANY, 520 South Mill St., New Castle, Pa.
JOHNSON B BEARINGS Sleeve Type

Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

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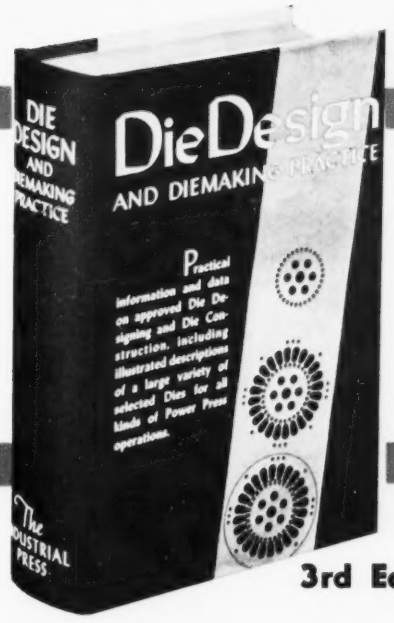
For more information on products advertised, use Inquiry Card, page 247


DIE DESIGN AND DIEMAKING PRACTICE
Practical information and data on approved Die Designing and Die Construction, including illustrated descriptions of a large variety of selected Dies for all kinds of Power Press operations.
The INDUSTRIAL PRESS

...Written BY Diemakers — FOR Diemakers

3rd Edition Revised and Enlarged

"Die Design and Diemaking Practice" is a comprehensive and authoritative treatise on the design, construction and application of all types of sheet metal-working dies. This book has long been a standard reference work in the metal-working industries, and has been used by some 40,000 diemakers, designers and tool engineers.

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Record of
LAKE ERIE PRESS PURCHASES
by BELL Aircraft

DATE	NUMBER	TONNAGE
1937	1	750
1939	1	2500
1940	1	275
1941	1	275
1942	1	5000
1943	1	275
1943	1	5000
1943	2	275
1943	+	500
1951	1	400
1952	1	7000

ABOVE. New 7,000 ton press is shown producing Bell helicopter parts...in this instance left-hand aft sills for the HSL-1 engine compartment. Material is 58.00" long by 6.50" wide by .091" thick. Two flanges and a contour are formed. Depth of draw is 3". Pressure required is 5,000 tons. Another new Lake Erie press appears in the background. It is a triple action model with a 400 ton capacity.

Other prominent Lake Erie Press users in the Aircraft Industry

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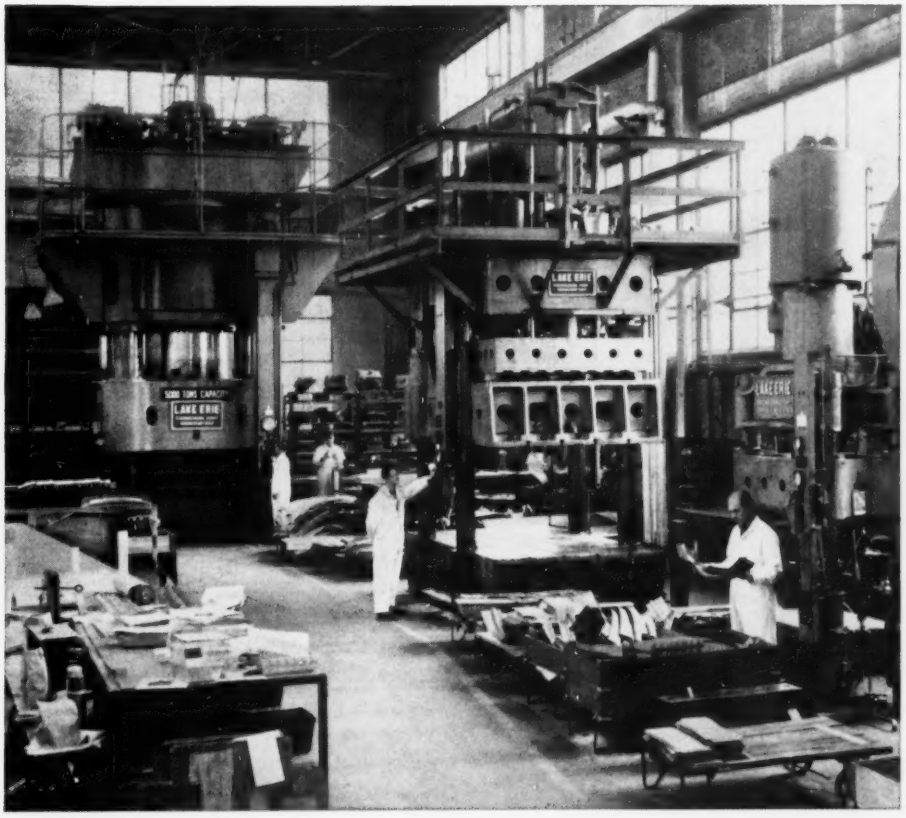
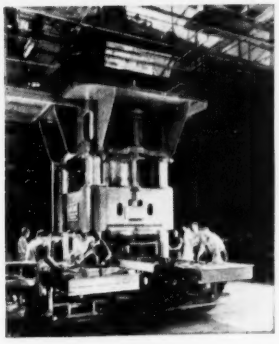


The 15th Lake Erie Press Purchased by Bell is a 7,000 Ton Unit for the New Helicopter Plant at Fort Worth

Bell Aircraft Corporation purchased its first Lake Erie press in 1937. Since then, 14 additional Lake Erie Presses have been added. These 15 presses have 5 different designs and six different capacities ranging from 275 to 7,000 tons. This year-in year-out satisfaction of Bell Aircraft and the variety of Lake Erie equipment involved are significant:

1. They reflect the competence and versatility of Lake Erie designers and builders.
2. They demonstrate that Lake Erie presses do their jobs with gratifying efficiency.
3. They prove that Lake Erie presses give years of the utmost satisfaction.

These are sound reasons why it is always good business to call in Lake Erie when hydraulic presses are under consideration.



ABOVE. A corner of the press room in the Bell Aircraft plant at Buffalo shows three Lake Erie presses with capacities of 5,000 tons, 750 tons and 275 tons respectively. The range in sizes and types, and the versatility of Lake Erie presses are a big asset to airframe, jet engine and accessory manufacturers.

LEFT. Bell's 5,000 ton Lake Erie press shown equipped with a rubber pad. Lake Erie presses of this type are available in capacities from 500 to 7,000 tons producing up to 2,000 p.s.i. on the work. High speed hydraulically operated loading tables or electrically operated tables (as shown above) are available for all press sizes.

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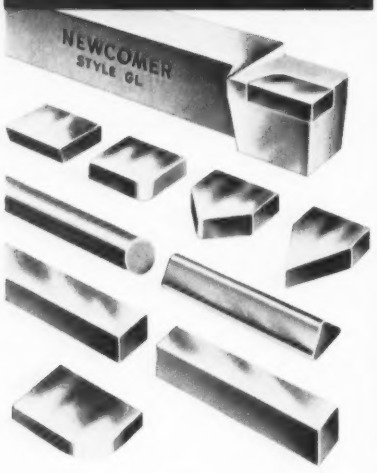

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Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
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Kaufman Manufacturing Co., Manitowoc, Wis.
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Van Norman Co., 3640 Main St., Springfield 7, Mass.

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace
Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature
General Electric Co., Schenectady, N. Y.

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Oakite Products, Inc., 19 Rector St., New York, N. Y.

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Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

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Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
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Westinghouse Electric Corp., Pittsburgh 30, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
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Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
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Tomkins-Johnson Co., Jackson, Mich.

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Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburgh, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
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Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
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(*Continued on page* 408)

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ALLIED provides industry's most complete SHEET METAL DIE SERVICE

What constitutes the all-inclusive service offered by Allied's Allite Division in Hillsdale, Michigan?

Facilities include,a plaster pattern shop . . . foundry and manufacturing facilities for sheet metal dies made of plastic, zinc alloy and iron . . . a wide range of press equipment . . . a fully equipped metal shop for finishing of stamped parts.

Five presses of medium-to-large capacities are utilized for tryout and for short run production of customers' parts such as those used in prototype assemblies. The largest and newest (installed during 1953) of these presses is the 1500-ton triple-action Clearing hydraulic press shown at the right. With 60-inch stroke and a bed, ram and blankholder area of 8 feet by 13 feet, it provides adequate capacity for dies up to the largest sizes.

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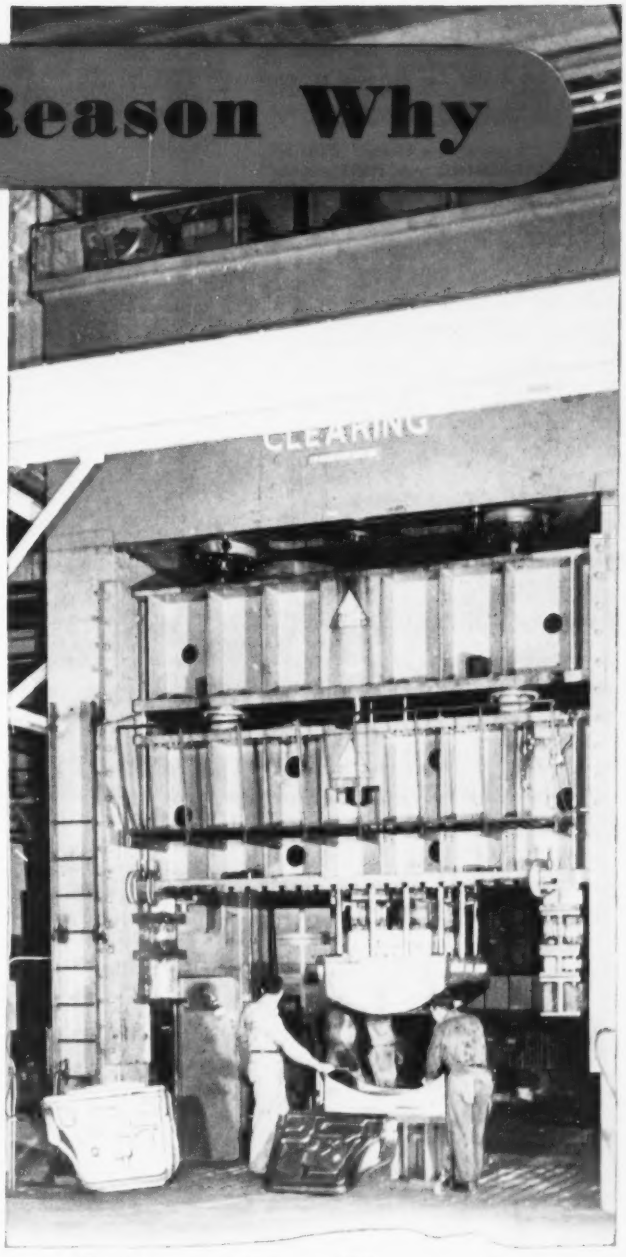

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
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Grob Bros., Grafton, Wis.
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Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp., 401 Broadway, New York 13, N. Y. (Portable).
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

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Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
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Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., E. Penna, Ave., Towson, Md.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

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Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madisor 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
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THE RUTHMAN MACHINERY CO.

1807 Reading Road Cincinnati 2, Ohio

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Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave., and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
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Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
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Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

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Allen Mfg. Co., 133 Sheldon St., Hartford 2 Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
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Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

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Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770 Saginaw, Mich.
Morey Machry, Co., Inc., 410 Broome St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

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De Laval Separator Co., Poughkeepsie, N. Y.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

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Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg. Cleveland 1 Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Summerill Tubing Co., Div. Columbia Steel & Chicago 18, Ill.
Shafting Co., P. O. Box 1557 Pittsburgh, 30, Pa.

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National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hendey Machine Co., Inc., Torrington, Conn.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(Continued on page 410)

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SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Cold Drawn Steel

Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div. Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilburn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheriden Rd., Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron &R. R. Co., Div.), 436 7th Ave. Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Street Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SOLDERING UNITS

Wasserlein Mfg. Co., 126 W. Cass St., Joliet, Ill.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baker Bros., Inc., Sta. F., P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.

(Continued on page 412)

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp. 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, Geo. Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hanniffin Corp., 1101 S. Kilbourn Ave., Chicago.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
John, B. Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch Match & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectary, N. Y.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STAMPINGS, Sheet Metal

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Laminated Shim Co., Inc., Glenbrook, Conn.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockfeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Stele Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Scanter No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co. Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div.) 436 7th Ave., Pittsburgh, Pa.,
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg, Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St. Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Redeemer, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div. Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

(*Continued on page* 414)

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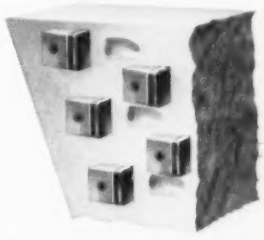

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STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenters Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

STONES, Oil or Sharpening
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STRIPPING UNITS, Die
Wales-Strippit Corp., N. Tonawanda, N. Y.

STUD SETTERS
Errington Mechanical Laboratory Inc. 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES
Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
Centrol Products, Inc., (Waterproof and Thermol), 306 Sussex St., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

TACHOMETERS
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

TAPER PINS, Standard
Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thrittmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3 Ohio.

TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS
Besly-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O. Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

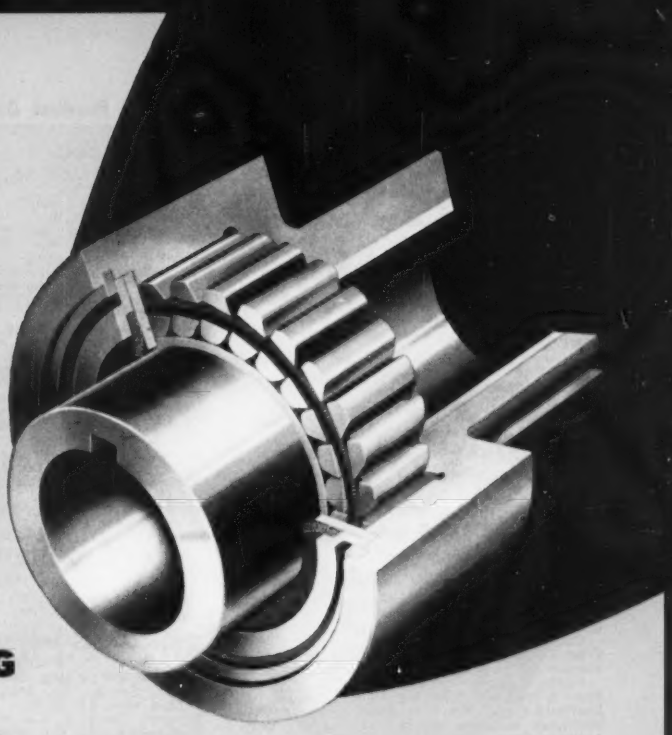
TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.

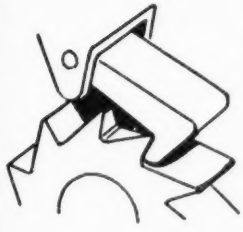
(Continued on page 416)

Evolution of the Modern Clutch



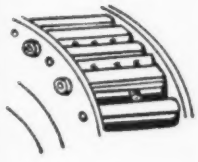
FOR OVER-RUNNING, INDEXING, BACKSTOPPING

First . . . Ratchets



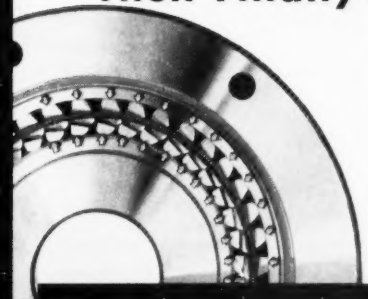
Feeding was inaccurate because of the inherent backlash and speed was limited. It provided only one indexing position and one indexing rate, determined by the number of teeth. And, it was noisy.

Then . . . Rollers



This type had widely spaced rollers. High capacity was not possible without many rollers, resulting in a bulky, space-taking clutch. Clutch life was short: the rollers always gripped at the same inner-race positions.

Then Finally . . . A Full Complement of SPRAGS



This most modern of clutches—the Formsprag Full Complement—has sprags running on concentric races without ramps. Design of the sprag provides a greater load capacity than any other type of working member. And—there are *more* working members (sprags) than in any other clutch-type. Formsprag's full complement of sprags always means MAXIMUM TORQUE CAPACITY in a small, compact unit.

FORMSPRAG is the FULL COMPLEMENT Clutch!

FORMSPRAG Company

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Your file should have this folder picturing and describing FORMSPRAG CLUTCHES. Write for it!

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DISTRIBUTORS IN PRINCIPAL CITIES

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Your inquiries about Balansprag and Cagedsprag Over-running Clutches are welcomed by the Formsprag Company.

Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., Beloit, Wisc.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Maxwell Co., 420 Broadway, Bedford, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Milholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Switzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Western Tool & Mfg. Co., 1640 Wheeler St., Springfield, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Kennametal, Inc., Latrobe, Pa.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
OK Tool Co., Milford, N. H.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Halpern, Wm., Co., Inc., 100 Stevens Ave., Mt. Vernon, N. Y.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland.

TUBE MILLS

Abbey-Etna Co., 2422 Maplewood Ave., Toledo 10, Ohio.

TUBING, Aluminum

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.

(*Continued on page* 418)

Cam Specialists — plus specially designed equipment! That's the reason why Rowbottom is known as cam-making—and cost-cutting headquarters. Whenever you need cams, in any size, type, or quantity, you can be sure that Rowbottom-made cams, will be right in design and in price

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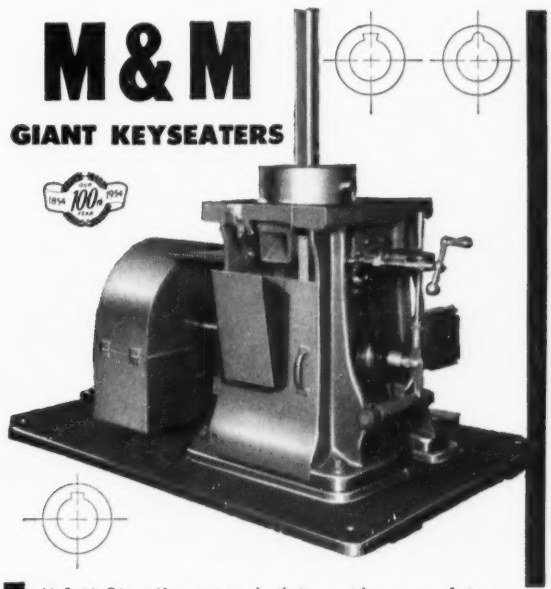
WATERBURY, CONN, U. S. A.

Rowbottom for Cams

M&M

GIANT KEYSEATERS



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Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS

See Drills, Twist

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

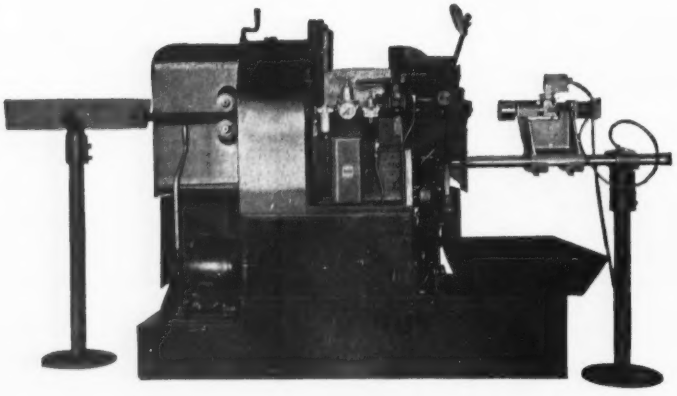
VALVE CONTROLS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Hannifin Corp., 1101 S. Kilburn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

The NEW MODERN AUTOMATIC
CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

4" Threaded Studs

Cut and chamfered at one time—in 8 seconds—from 10 ft. length of stock already threaded. (¾" U. S. Standard.) Clean cut. Clean chamfer. Nuts start easily, with no extra finishing required.

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MODERN MACHINE TOOL CO.
Jackson, Michigan

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr. Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hendey Machine Co., Inc., Torrington, Conn.
Homestrand Inc., Larchmont, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VISES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, Lock

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WASHERS, Spring

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

For more information on products advertised, use Inquiry Card, page 247

WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
General Electric Co., Schenectady, N. Y., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.

American Electric Fusion Corp., 2606 Diversey Ave., W. Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Machine & Welder Co., Warren, Ohio

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Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

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Scott Paper Co., Chester, Pa.

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Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

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Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

WRENCHES

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Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Detachable Socket

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
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Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
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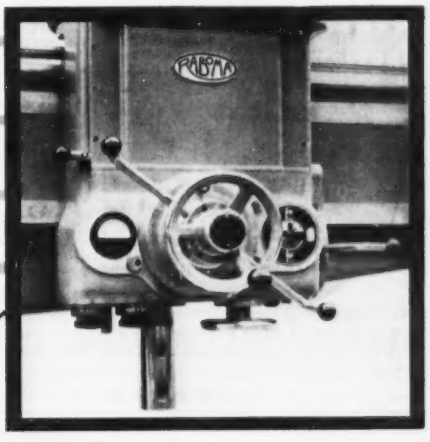

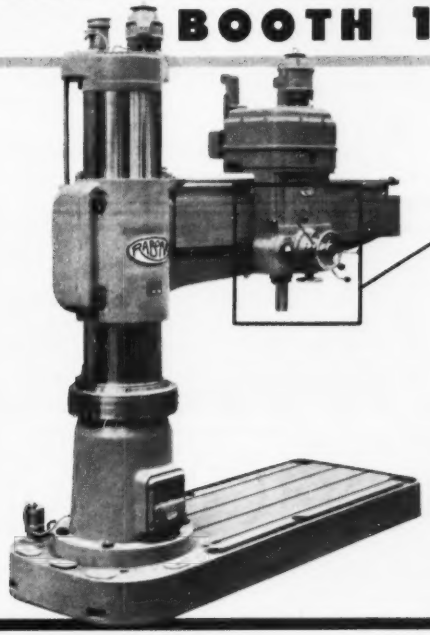

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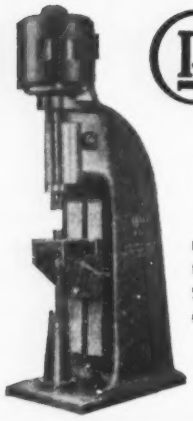

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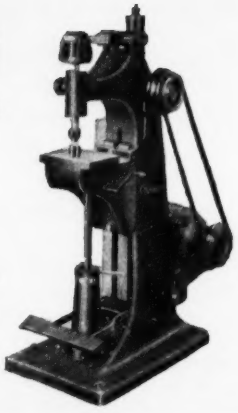

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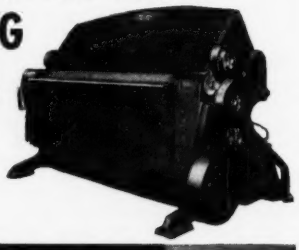

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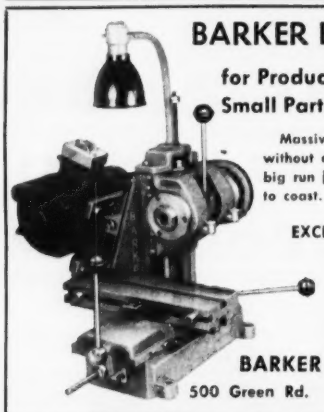
for Production Milling of Small Parts by Unskilled Help.



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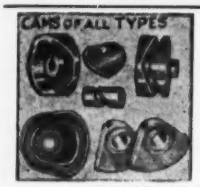

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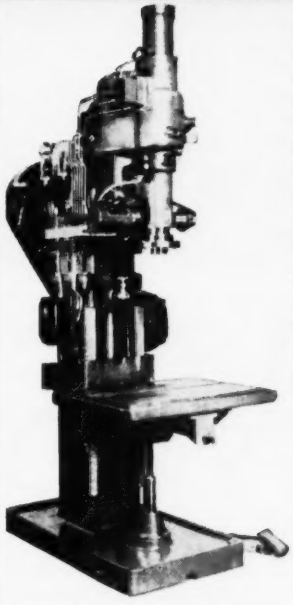

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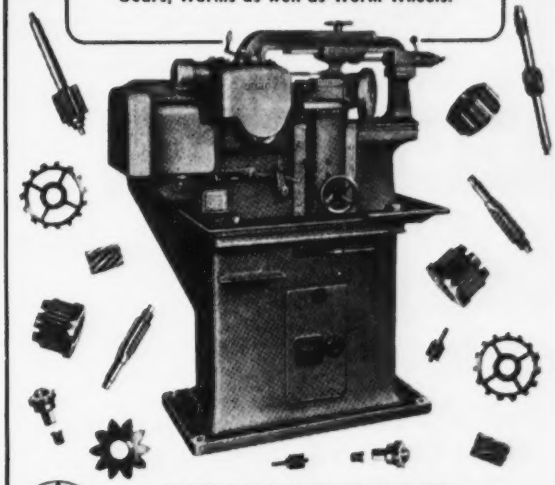
A Universal Purpose Machine for the economical production in either small or large quantities of Spur Gears and Pinions, Spiral Gears, Worms as well as Worm Wheels.



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Powerful, Dependable, Economical. For light work—stamping, framing, riveting—metal, fiber or other material. Overall height 17½" . . . Base size 8½" x 8½" . . . Die bed 5½" x 8½" . . . Ram face 1½" x 3½" . . . Ram stroke ¾" . . . positive ¾" ram adjustment . . . sturdy, single pin, non-repeat hand lever clutch . . . V-belt drive . . . weight 105 lbs.

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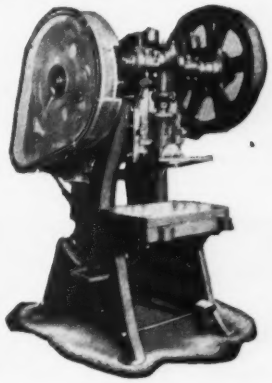

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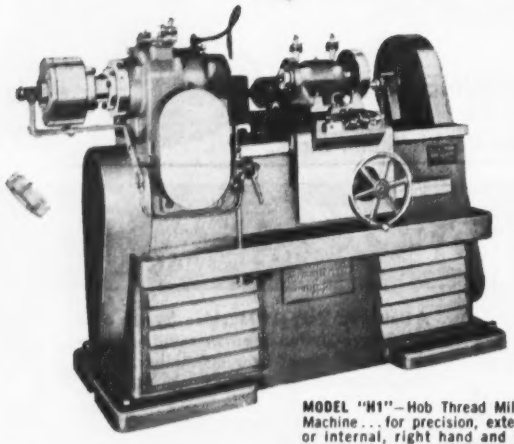

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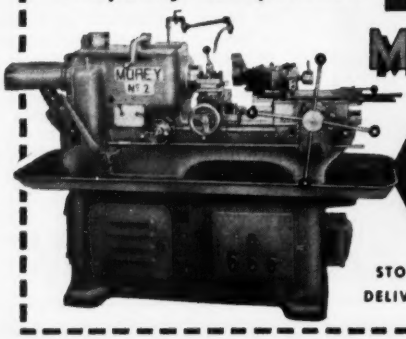

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Fifty feeds from 9/32" to 80" per Min.

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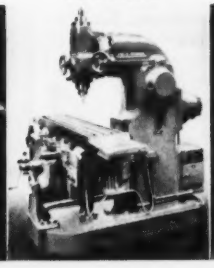

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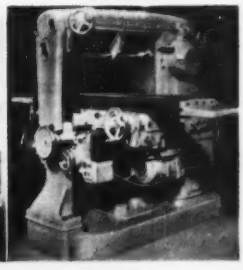

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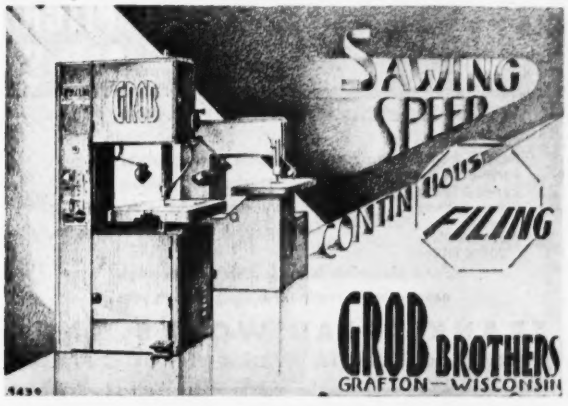

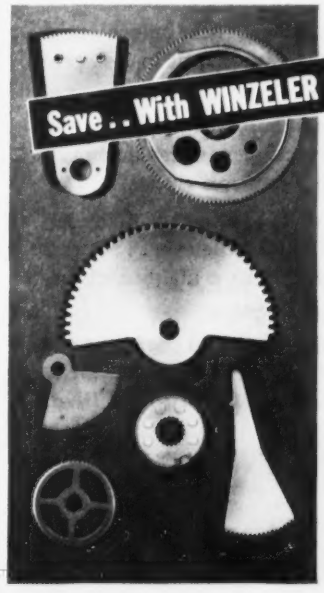

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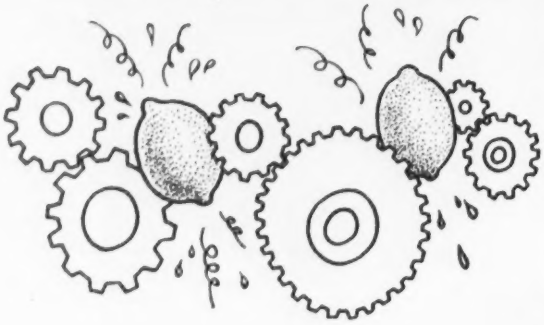
An Actual Case from the *Sier-Bath* Files

Two Noisy "Lemons" in a gear train . . .



. . . almost cost a large order

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The noise cooled off his prospect's interest—in a hurry. It told the prospect that gear failure would come quickly, and cost him plenty in lost production and repairs.

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This change did the trick . . . at a negligible cost. The manufacturer concluded the sale . . . and is now "back in business" with a highly satisfactory product.

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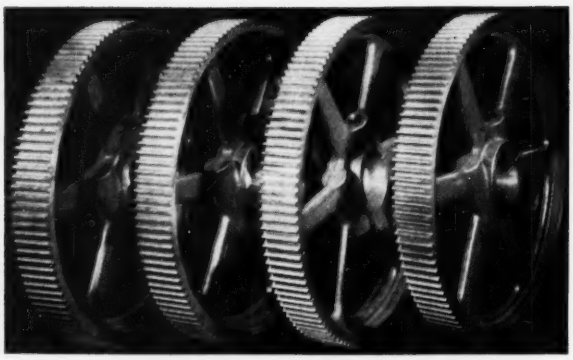
Proven accuracy where required!

Send for folder: "Gear Errors Are Costly!"

Also Manufacturers of Rotary Pumps and Flexible Gear Couplings



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Each of these cast iron clamp hub gears for paper mill use weighs 1300 pounds—accurately machined to give long, trouble-free service. Stahl has the experience, skill and production facilities to more than satisfy your most exacting gear needs—any size, any quantity, any material. Send for Stahl's estimate first!

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***AS* you want them — *WHEN* you want them**

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Spline Shafts & Spline Fittings

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Gears cut to particular specification. Design and emergency repair aids. Contract production on all type gears—metal on non-metallic.

DIEFENDORF GEAR CORPORATION
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"Don't have FITS over FASTENERS, have fasteners that fit."

For the finest in milled-from-the-bar cap screws—set screws coupling bolts and milled studs

don't get stuck—stick to the ones made by

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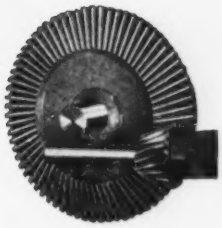

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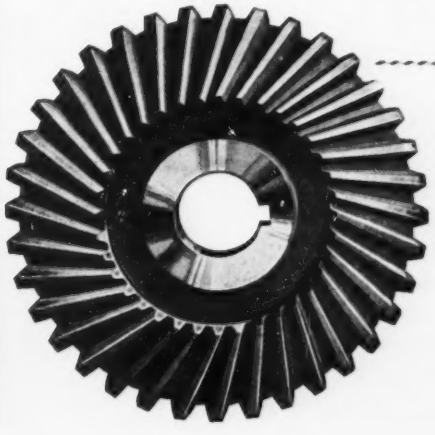

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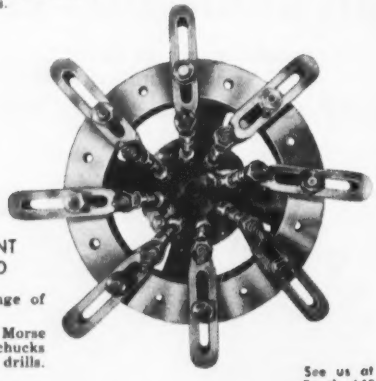

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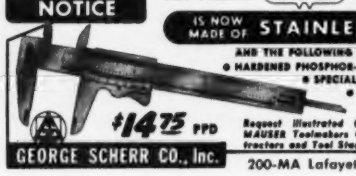

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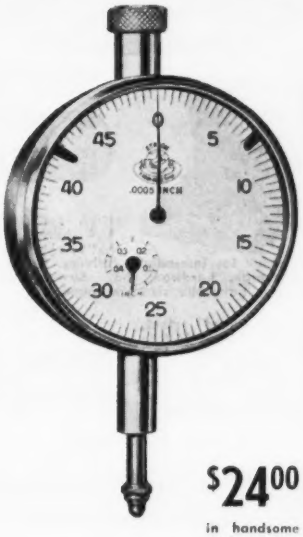

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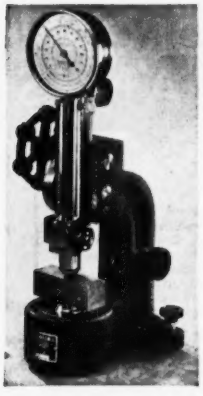

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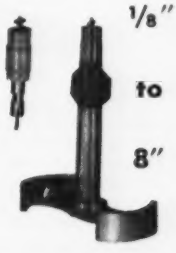

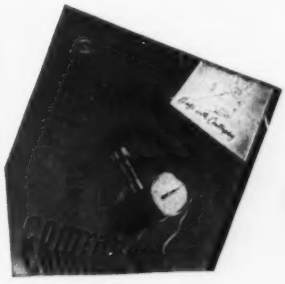

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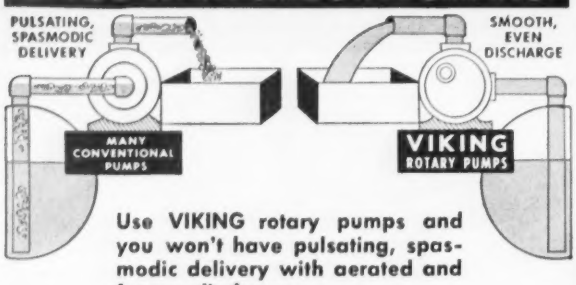

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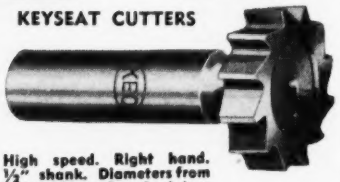

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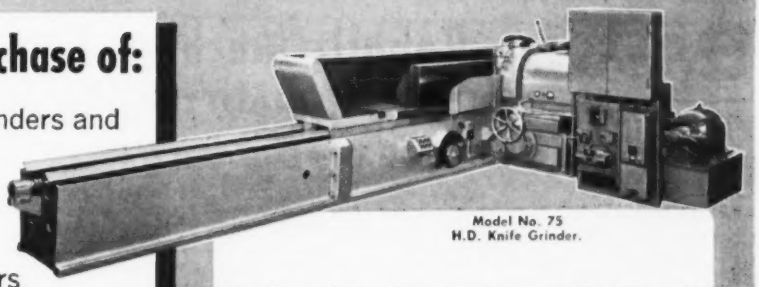

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2 spindle Avey, size No. 1, type B, style VHP, m.d., 8" overhang
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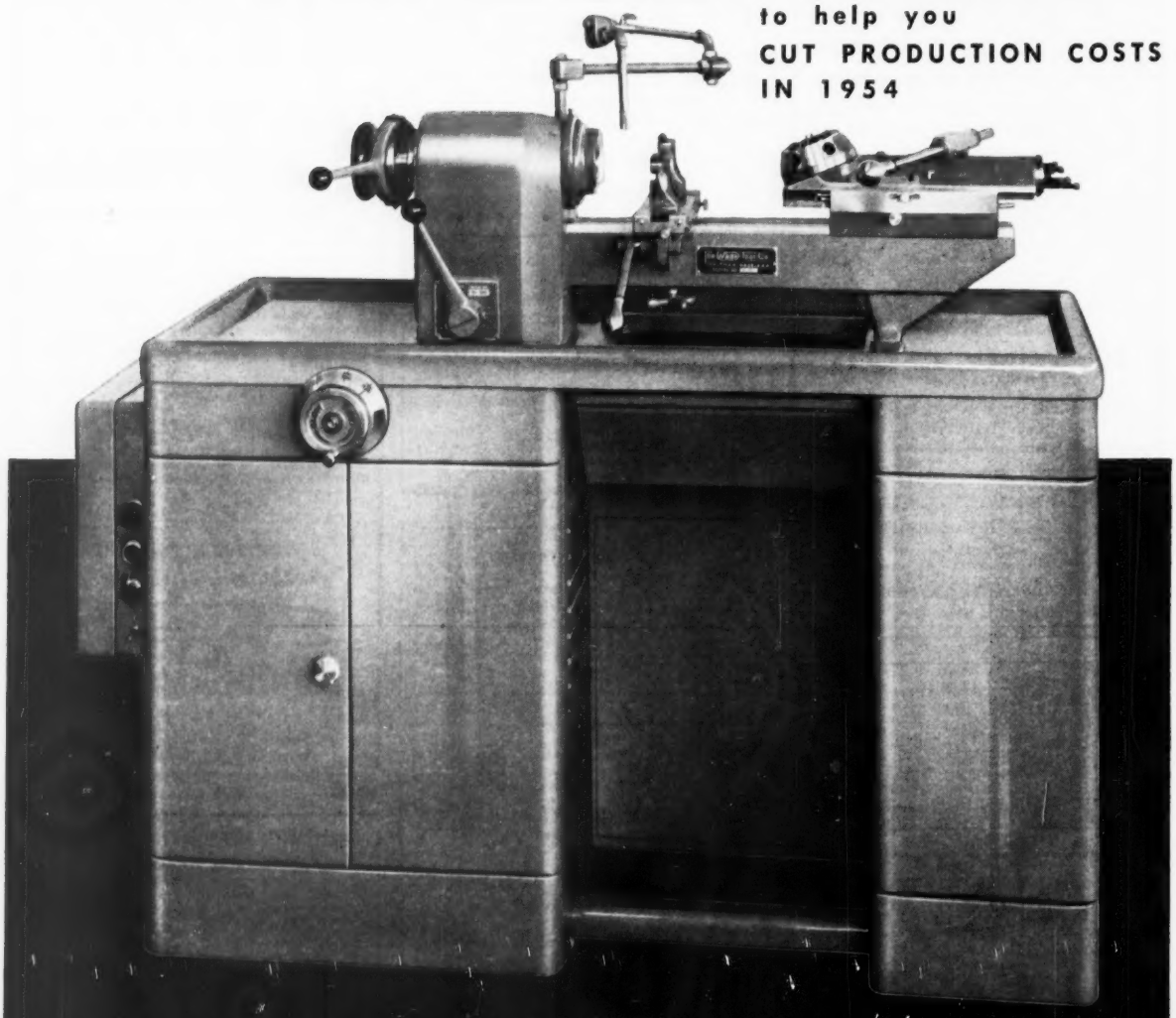

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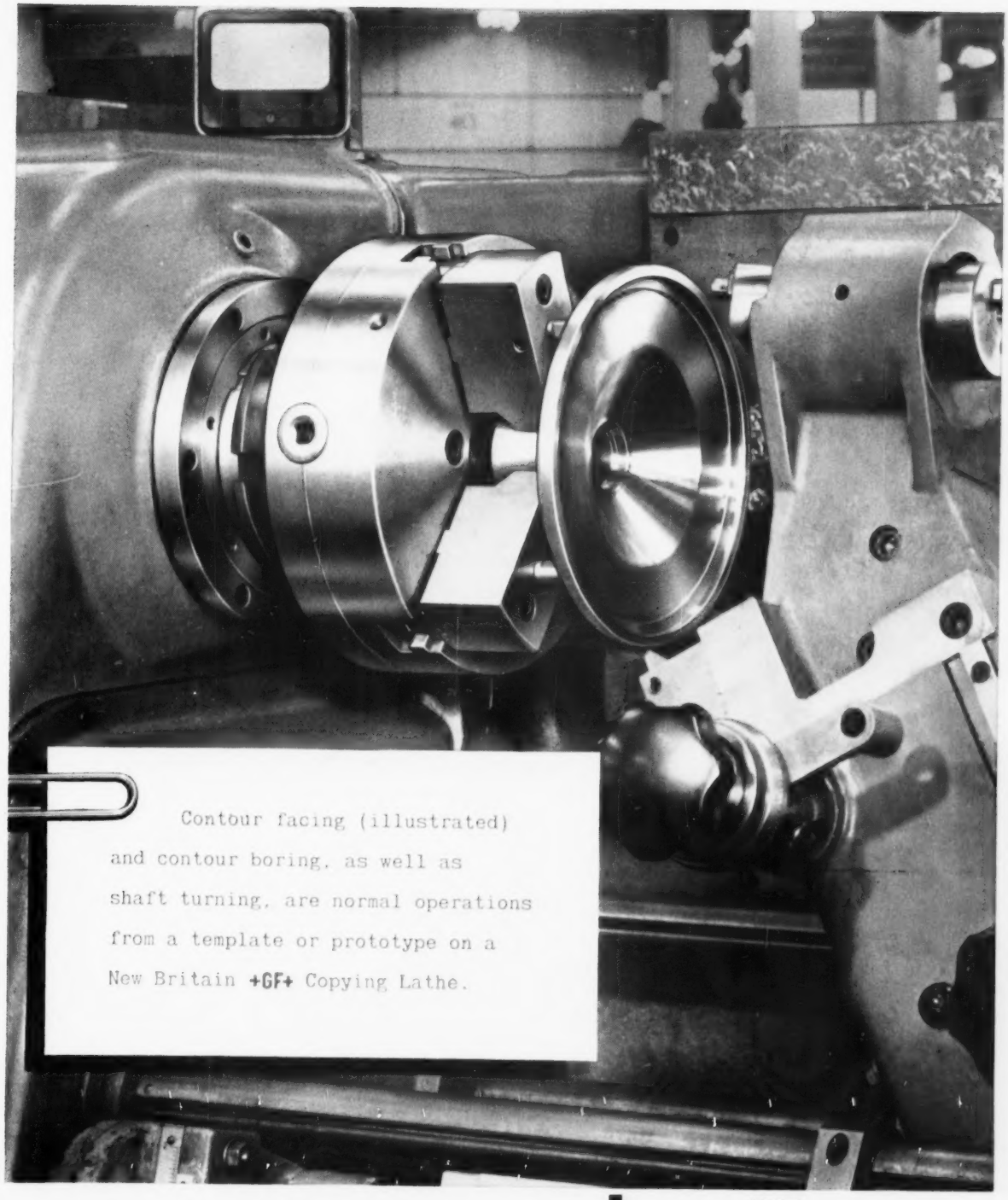

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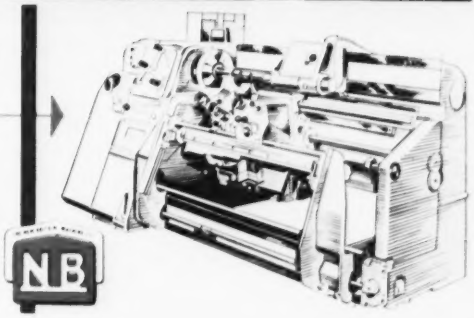

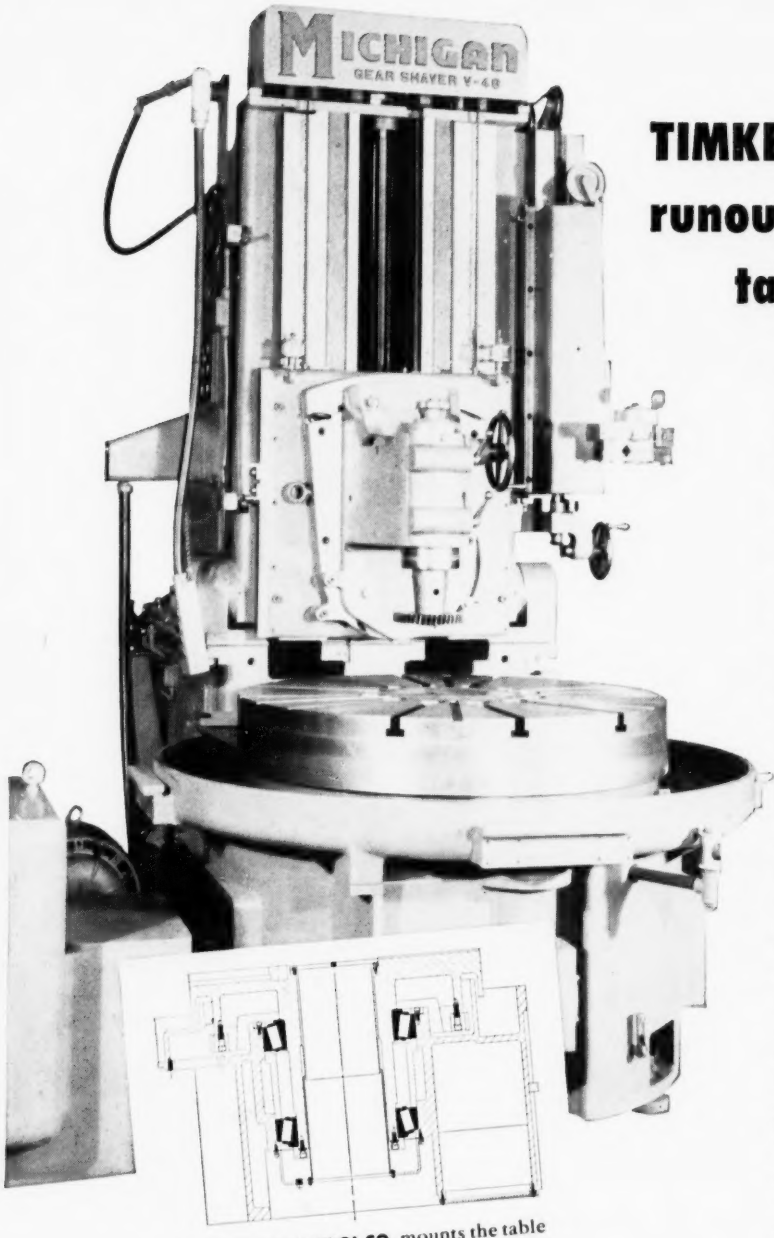

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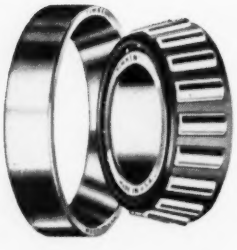

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